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

EDITORIAL

Welcome to issue 78 of the ITF Coaching and Sport Science Review. This issue covers a range of aspects in the game including: perfectionism, the return in the women's game, developing rhythm, the energy expenditure between players of different game styles, and many more. The review also features the 2018 ITF State of the Game Report, an analysis of technical and tactical developments in the top flight of the game.

Following its inaugural success in 2018, the 2nd ITF Worldwide Participation Conference was held on 7-8 July 2019 at Chelsea FC's Stamford Bridge Football Stadium in London, United Kingdom. More than 200 delegates from the sporting world were in attendance, and the topics were broad and wide-ranging: how data and measuring insight can be utilised, key drivers for growing participation, strategies for improving retention rates, how technology and esports can be harnessed in the quest to boost physical activity and how more women can be attracted to sport. 34 speakers presented across 11 different sessions including a keynote presentation from Tennis legend Billie Jean King, who was recently announced as the first Fed Cup global ambassador, and who provided a rousing conclusion to the opening day, offering her observations on boosting participation rates. Presentations are currently being published on the ITF Academy.

During the ITF Worldwide Participation Conference 2019, the ITF announced the World Tennis Number. This strategic project aims to implement a global, level-based tennis rating, designed to enable more matches to be played between players of similar levels, from beginners to professionals. The project is being chaired by an ITF steering committee composed of executives from the ITF, the LTA, la Fédération Française de Tennis, and the United States Tennis Association. Representatives from these associations presented about their collaboration with and future implementation of the project. More information can be found at www.worldtennisnumber.com.

The 21st ITF Worldwide Coaches Conference by BNP Paribas will take place in Bangkok, Thailand from 25-27



October 2019. Confirmed speakers include Mary Pierce, Emilio Sánchez, Mark Woodforde, Eric Winogradsky, Beni Linder, Merlin van de Braam, Jo Ward, Li Chen, Michael Ebert, Craig O'Shannessy, and many more. Over 30 speakers from around 20 nations will present at the conference, and on the final day, an interactive session will be held where delegates can put their questions to the speakers face-to-face. Registration will close in September. Please click [here](#) to find out more.

The ITF Academy, the ITF's online educational platform, was officially launched in March 2019. All the content from Tennis iCoach has been migrated to the ITF Academy which will now be the new home for the Tennis iCoach library. The ITF Academy offers online courses which will eventually support the face-to-face delivery of courses, providing an improved blended learning experience. The ITF Academy is available to all ITF member nations as well as individual coaches. To date there are a total of 8 courses in English on the ITF Academy, some of which are also available in Spanish and French. Click [here](#) to register for the ITF Academy.

Finally, we would like to thank all the authors for their contributions, as well as all of those who sent in proposals. We hope that you enjoy reading the 78th edition of the ITF Coaching and Sport Science Review.

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Other oriented perfectionism in tennis coaching

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ITF Coaching and Sport Science Review 2019; 78 (27): 3-5

ABSTRACT

Other oriented perfectionism describes a pre-occupation with the expectation that others will achieve excessively high standards of performance. Projecting unrealistic expectations on to each other in a player-coach dyad may disrupt the working relationship and impact on the athlete's experience within the sport. This study uses Interpretive Phenomenological Analysis to explore, from the coach's viewpoint, the effects of other oriented perfectionism in tennis coaching. After conducting semi-structured interviews with high level coaches from the United Kingdom, two superordinate themes emerged. 'Negative effects of coaches' other-oriented perfectionism' and 'Redefining perfectionism'. The findings of this study assist in highlighting areas for possible intervention as well as identifying avenues for future research.

Key words: other oriented perfectionism, coaching, expectations, performance

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Article received: 15 March 2019

Article accepted: 29 April 2019



High perfectionistic strivings are generally considered to be adaptive in the sports arena, driving for example, attention to detail, commitment to training and a desire to improve. However, excessive levels have also been shown to correlate with an increased potential for the use of performance enhancing drugs (Flett & Hewitt, 2005). Perfectionistic concerns defined as “concerns over making mistakes, fear of negative social evaluation, feelings of discrepancy between one's expectations and performance, and negative reactions to imperfection” (Gotwals et al., 2012; p. 264) have been shown to correlate with ego orientation, mastery avoidance and a range of negative emotions (e.g., negative affect, anxiety, and anger) (Hill, Mallinson-Howard, & Jowett, 2018).

The concept of ‘other oriented perfectionism’ has received limited research attention but is crucially concerned with the demand for perfection conveyed by one person towards another individual (Hewitt & Flett, 1991). Other oriented perfectionists create high expectations for others and constantly compare them against the high standards they set. Over a decade ago Flett & Hewitt (2005) highlighted the possible role that other oriented perfectionism may play in coaching, questioning the application of this theorizing to sport, asking, for example “At what point do the perfectionistic demands of coaches contribute to a loss of motivation in athletes?” (p.17).

The extant literature considering player-coach relationships is currently dominated by quantitative data and analysis. However, relationships in sport mirror those in wider societies to the extent that they are defined by intricacies and nuances that cannot be quantified. As such it would appear that the impact of one's perfectionistic tendencies on the player-coach relationship is an area that may be suited to more qualitative investigation. Sellars, Evans & Thomas (2016) recently emphasized this point stating that; “a reliance on quantitative research designs has resulted in a limited insight into athletes' perceptions of the effects of perfectionism within sport.” (p.220). Interpretive Phenomenological Analysis (IPA) is one approach that lends itself to understanding novel phenomena (Malhotra, 2015). By exploring a certain experience/phenomenon with genuine depth, important information can be provided which may open other avenues of exploration. The current lack of literature on how perfectionism affects the player-coach relationship makes IPA a fitting qualitative research method to employ in this study.

This short review aims to explore, from a tennis coach's perspective, the perceived influence of other oriented perfectionism on the player-coach relationship. In doing so it

INTRODUCTION

According to Cockerill & Jowett (2002) the coach-athlete relationship serves as a platform from which the coach and the athlete interact in unique ways in order to bring about performance accomplishments, success and satisfaction. Relationships such as in this example are sustained on the basis that the actions of one agent affect the behavior of the other which in turn influences how that person then behaves towards the original agent. On this basis any factor that influences how, and what, an individual communicates to someone else will also be implicated in determining the likely course and outcomes of social interactions.

Perfectionism, defined as “the setting of excessively high standards of performance in conjunction with a tendency to make overly critical self-evaluations” (Frost, Marten, Lahart, & Rosenblate, 1990; p.450) is one such factor that may influence interactions and consequently relationships between a coach and tennis player. To date, perfectionism has largely been viewed from an athlete's perspective and considered as a personality characteristic linked to both maladaptive (e.g., burnout) and adaptive (e.g., commitment) outcomes. Perfectionism has been described across two dimensions namely ‘perfectionistic concerns’ and ‘perfectionistic strivings’.

is hoped this review will both increase coach awareness of the phenomenon and highlight some outcomes associated with other oriented perfectionism in coaching.

METHOD

Participants

Participant sampling in IPA focuses on the small and is purposive, and given that the current work was exploratory in nature and meant for illustrative purposes only a small but homogenous sample was sought. Participants were selected because they have important experiences and perspectives about the phenomenon under study. Ethical approval to conduct this research study was granted by the ethics committee of the lead author's institution. Participants from various tennis clubs in London, United Kingdom were contacted by 'cold' e-mailing and then followed up face to face after an initial response was received.

Coach X is a male PTR (Professional Tennis Registry) certified and LTA (Lawn Tennis Association) level 4 coach. He has played at numerous British tour and ITF futures events and has been coaching full-time for 29 years. Coach Y is female and a PTR instructor certified. Coach Y has an LTA level 3 license, and 17+ years of experience in tennis. Coach Z is a Male PTR professional level certified coach with an LTA level 4 coaching license. This coach has 43 years of experience in tennis, and 20 years' experience of educating other coaches as a certification instructor. All three coaches are from the United Kingdom (U.K.) and have a vast majority of their tennis experience from the U.K.

PROCEDURE

This study conducted multiple semi-structured individual interviews lasting 25 - 40 minutes. Before the interviews commenced, participants signed consent forms and received printed or electronic copies of information about the study and contact information for the researcher. The interviews were recorded using an audio recording device. Each interview took place in different pre-planned private spaces at various tennis clubs in London.

Each audio recording was transcribed verbatim and checked by the coaches to ensure that the text accurately reflected their intended message. Following this, the data was read and interpreted with themes being extracted from the data. After completion of data analysis, all private electronic and hardcopy data was destroyed and all personal data was not kept for longer than necessary for the purpose(s) for which it was collected.



DATA ANALYSIS

IPA was developed by Smith (1996) and has its origins in hermeneutics and phenomenology. Data in this study was analyzed from a bottom-up approach meaning that instead of applying existing theories to the data collected, codes/themes were generated from the data itself. The codes generated from the data are a result of the IPA process with the researcher mixing descriptions and insight generated from the participant's accounts. IPA analysis utilizes multiple reading and note taking cycles to help immerse the researcher within the data. When extracting themes any inferences that are drawn from the data are done so cautiously, and with a contextual awareness of the cultural, social, and other contextual factors in which the study is concerned.

RESULTS & DISCUSSION

Superordinate Theme I:

'Negative effects of coaches' other-oriented perfectionism'

The coaches reported mainly negative effects on the player-coach relationship from displays of other-oriented perfectionism. Interestingly this came through strongly in accounts when reflecting on the coach's own playing career and was not referred to as an issue in their current coaching practice. This may indicate a lack of awareness, or perhaps a reluctance to accept the role that the coach's perfectionistic tendencies may play in influencing their current performers.

Coach Y responded:

"So, I had a coach that was extremely attentive to detail, like always wanted perfection and it just put too much pressure on us as players. And I think it had a negative impact on our performance because we were always worried about doing something wrong... personally I was more nervous, and I know others were nervous too."

Coach Y indicated that a negative impact on the player-coach relationship resulted from a loss of respect, "I think that I had lost respect for her, which is a big thing for me to have between your player and coach". Cockerill & Jowett (2002) highlight that to achieve a healthy player-coach relationship, appreciation and respect for each other as individuals is essential. This scenario illustrates how a coach's perfectionistic strivings can impact on the bond between an athlete and coach and thus disrupt an athletic working alliance.

Coach Z suggested that coaches can "lose motivation/interest in coaching tennis because of their negative experiences in perfectionistic tennis environments". This quote touches on the potential for organizational perfectionism to be conveyed by expectations projected by parents, head coaches or sponsors in any given environment. A significant body of literature already exists highlighting the need to create mastery climates where emphasis is placed on effort and task mastery. This structure needs to permeate throughout the whole performance environment, creating a culture of support and acceptance for players and coaches, acknowledging that at times things may not work out as planned.

Coach Y describes how at times in her playing career a watching coach had the potential to make her feel, "physically sick and emotionally extremely stressed". She goes on to state,

"some were able to cope better than others. I was someone who - I'm very sensitive so I will take information very personally and sort of put it on my shoulders and it would definitely impact me, whereas there were girls who didn't have those cares as much as I did."

The excerpt touches on the presence of individual differences in the way feedback from perfectionistic coaches is interpreted and how different athletes cope with negative performance information. This emphasizes the need for coaches to be aware of their own perfectionistic tendencies and for the need to attenuate how this is transmitted to the range of players in their group.

Superordinate Theme II:

'Redefining perfectionism'

Reflecting on various athletes that the coaches had worked with and the relationships they developed with their players, Coach X commented;

"There was a girl I worked with, and all of the coaches knew about her and would sort of comment to each other about, we need to let her know that she can't expect perfection with tennis.

...she was actually a dancer, which was interesting, because I think dancing teaches you to try and achieve perfection, so I guess you try and perfect a move.

...when she missed, she found it really really hard to understand why she was making that mistake. So, she would constantly say, why did I miss that? Why am I - why do I suck? Why am I not playing well? And we had to make her realize that that's kind of tennis."

When the young athlete projected her understanding of perfectionism established in dance to tennis this caused uncertainty and frustration. The nature of tennis is such that external factors influence the outcome so there is always an element of performance that is outside of one's control. An understanding that external regulation, or just that factors outside our control sometimes act upon us, causes unrest in certain personality types. Joint awareness may help to rationalize these feelings in both the athlete and coach and promote a sense of coping in times when perfection is not reached.

Exploration into how multi-sport athletes develop and transfer their idea of perfectionism from one sport to another also seems like an interesting area to pursue. Tennis coaches may benefit from understanding how messages around perfectionism are inherently communicated in different sports. In this light, tennis might learn from team based sports where the achievement of perfectionism lies more naturally in a collective effort as athletes are dependent on each other for success.

In bringing this review to a close Coach X provides for a nice summary and recommendation for other coaches,

"Coaches should be vigilant around keeping a casual check on how an athlete describes their performance in training or matches either through purposeful dialogue with the coach or self-talk during contests. Elevated perfectionistic concerns need to be challenged early through education via discussions with the player working to understand and then replace dysfunctional perceptions around the need to achieve perfection to reach the top of the game."

The purpose of this review was to raise awareness of the role that perfectionism plays in influencing the player-coach relationship and the development of an athlete in tennis. Future research might examine situations where player-coach perfectionist combinations either align or are at odds with each other and the resultant influence these combinations have on various outcomes. Work might also consider other key agents in the player's immediate environment such as parents and how their perfectionistic tendencies influence a child's long term development in a sport. Bringing these two ideas together it may be that parent-coach perfectionistic tendencies need to align so that this essential aspect of the developmental triangle functions effectively for the good of the player.

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[RECOMMENDED ITF TENNIS ICOACH CONTENT \(CLICK BELOW\)](#)



Characteristics of the return in professional women's clay court tennis

Rafael Martínez-Gallego and Arnau Giner (ESP)

ITF Coaching and Sport Science Review; 78 (27): 6-9

ABSTRACT

The number of studies related to notational analysis of the serve has grown in recent years, and this latest research has suggested that: players win more points with the return of serve at younger age groups; with males, there is more variation in the direction and more points are won on the forehand than the backhand return; and, women return closer to the net with a flatter trajectory than their male counterparts. Despite advances in research there is still little known on female tennis, especially on clay courts. 795 points of female matches at the BBVA Open Valencia 2017 ITF event were analysed. On the first serve, on the advantage side, players use mainly backhands and hit crosscourt, whereas on the deuce side, there were no significant differences in forehands and backhands hit, and there was more variation in direction. On the second serve, on the advantage side of the court, players still mainly used backhands but hit more shots down the line; whereas on the deuce side, players hit mainly inside-out forehands and there are no differences in the direction hit.

Key words: return of serve, women's tennis, direction, clay

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Article received: 18 June 2019

Article accepted: 10 July 2019



- Professional players were the ones who scored the fewest points on return of first serves.
- 16&U players won equally on the first serve return and second serve return.
- 12&U players won a higher number of points on return of first serve, according to the two study cases.

According to Kovalchik and Reid (2018), in male players on hard court, there is a greater variation in the direction with returns with the forehand than with the backhand and, in fact, a higher number of points are scored by returning with a forehand than with a backhand. Moreover, when it comes to varying the direction of the return, girls vary more than boys. Finally, regarding this study, in male players, conclusions can be drawn that a higher number of points are scored by returning fast and flat as opposed to high and with topspin.

In a recent study by Reid, Morgan and Whiteside (2016), which compared the differences between women and men at the Australian Open, it was concluded that women returned closer to the net, hit the ball lower and with a flatter trajectory than men.

As can be seen, in spite of the fact that in recent years the information available regarding the tactics used by the players for return has increased, there is little information about women's tennis, and none about women's tennis on clay courts. That is why the objective of this article is to describe and analyse the potential differences of the main characteristics of the return in the women's game on clay courts.

METHODS AND PROCEDURES

Sample

The sample of this study consisted of 15 sets corresponding to 7 matches at the BBVA Open Valencia 2017 in which 795 points were analysed, a tournament that takes place in November in the facilities of the Valencia tennis Club and is played on clay courts outdoors. The matches were played by professional female tennis players who are ranked between 200 and 900 in the WTA world ranking. All the players were right-handed. The average age of the players was 23.1 years old. In order to be able to record matches during the competition, written consent was obtained from the tournament organisers.

INTRODUCTION

The return is fast becoming one of the most important strokes in modern tennis. As a matter of fact, different articles can be found in previous issues of this review which focus on this skill (Zawadzki and Roca, 2009; Aviles, Bengugui, Beaudoin and Godart, 2002; Bolletieri, 1995; Hedelund and Rasmussen, 1997; Kleinoder, 2001). Furthermore, in recent years, through notational analysis, it has been possible to obtain more reliable and objective information from different indicators that are of interest for the assessment of tactical performance of players (Martínez-Gallego, 2018). This has led to the existence of a significant number of studies that, through this type of analysis, have provided very interesting information related to the return. In this article, the main conclusions of some of the most relevant studies of this area will be drawn.

Gillet, Leroy, Thouwarecq and Stein (2009) analysed the effectiveness of the serve and the return on clay courts according to the effect and the direction in male tennis players. The main conclusions obtained were that the serve and the return had a great influence on the final score and, in addition, that the flat serves to the "T" and the return in the centre of the court were the strokes that were more effective for scoring points.

Furthermore, Hizan, Whipp and Reid (2011) also analysed the effectiveness of the serve and the return, comparing between professional players, 16&U high level players and 12&U high level players, without differentiating between their sex. The variables analysed were the type of serve, the type of return and the winner of the point. The main conclusions obtained were the following:

Variables analysed

The variables analysed in the study are the following:

Independent variables

- Side of the court – The side where the player serves (deuce/ advantage).
- Type of serve – The type of serve performed (first or second serve; open/body/T).

Dependent variables

- Type of return – The type of stroke performed for the return (forehand / handback / inside-out forehand / inside-out backhand)
- Return zone – The side where the return bounces (down the line / cross-court)

Statistical analysis

Statistical analysis was carried out using the SPSS statistical package version 21 for Mac (SPSS Inc., Chicago, Illinois, United States). The Kolmogorov Smirnov test was performed to check the normal distribution of the data in each of the variables, and this obtained atypical values and large differences in variance in all variables derivations of normality, thus non-parametric tests were used. The Friedman test was used to check if there were significant differences between the different variables analysed. In order to compare data between winners and losers, the Wilcoxon signed-ranks test was used.

RESULTS

First serve return

With regard to the type of return, graph 1 shows how, on the deuce side, the percentage of forehand and backhand returns was significantly higher than the other types of stroke. On the advantage side (graph 2), the most commonly used type of stroke was the backhand.

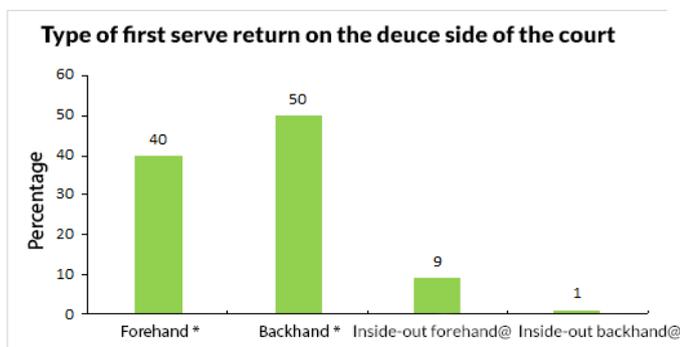


Figure 1. Percentage of first serve returns on the deuce side of the court, according to the type of stroke. * Significant difference ($p < 0,05$) to inside-out forehand and inside-out backhand. @ Significant difference ($p < 0,05$) against all other types of stroke.

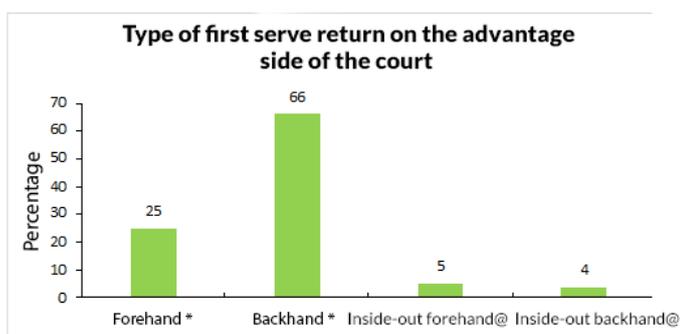


Figure 2. Percentage of first serve returns on the advantage side of the court, according to the type of stroke. * Significant difference ($p < 0,05$) to all other types of stroke. @ Significant difference ($p < 0,05$) against forehand and backhands.

Regarding the trajectory, as can be seen in graph 3, the players performed a significantly higher percentage of down the line returns on the right side. However, on the advantage side, they performed a higher percentage of cross-court returns.

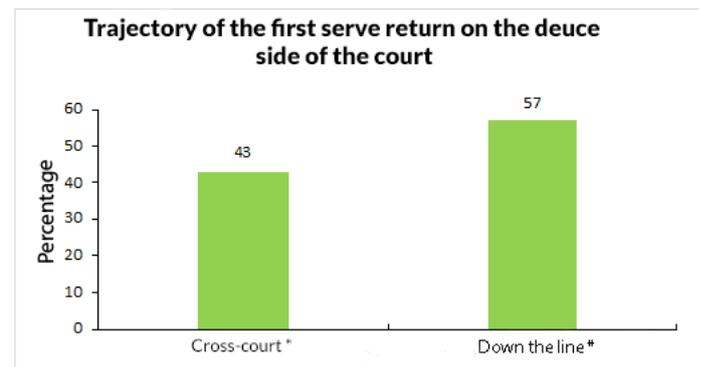


Figure 3. Percentage of first serve returns on the deuce side of the court, according to the trajectory of the stroke. * Significant difference ($p < 0,05$).

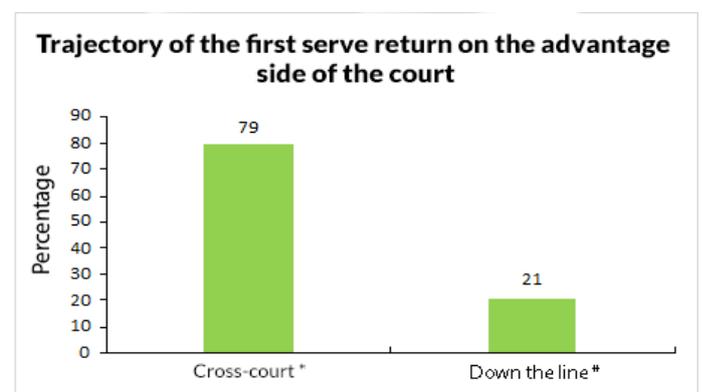


Figure 4. Percentage of first serve returns on the advantage side of the court, according to the trajectory of the stroke. * Significant difference ($p < 0,05$).

Second serve return

On the deuce side, as can be seen in figure 5, there is no difference in the percentage of forehands, backhands and inside-out forehands, and a trend ($p = 0,56$) indicates that the percentage of inside-out forehands was significantly higher. As far as the advantage side is concerned, the type of return that was performed the most was the backhand return.

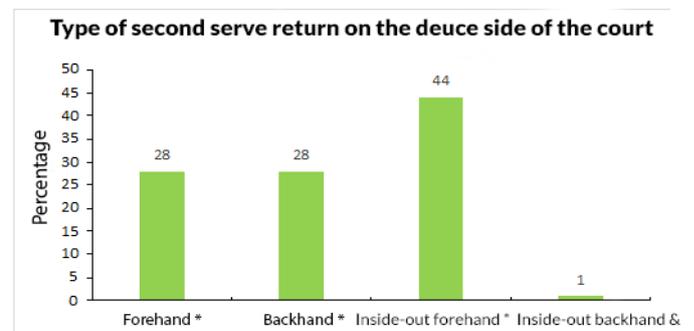


Figure 5. Percentage of second serve returns on the deuce side of the court, according to the type of stroke. * Significant difference ($p < 0,05$) against the reverse backhand. & Significant difference ($p < 0,05$) against all other types of stroke.

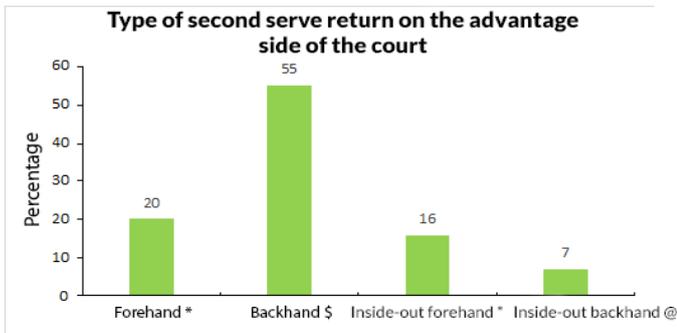


Figure 6. Percentage of second serve returns on the advantage side of the court, according to the type of stroke. * Significant differences ($p < 0,05$) against backhand and inside-out backhand. \$ Significant difference ($p < 0,05$) against all other types of stroke. & Significant difference ($p < 0,05$) against the backhand. @ Significant difference ($p < 0,05$) against backhand and forehand.

With regard to the direction of the return of the second serve, there were no differences on the deuce side (graph 7), while on the advantage side there were more down-the-line returns (graph 8).

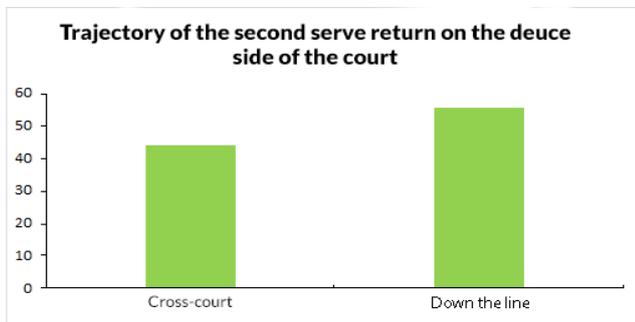


Figure 7. Percentage of second serve returns on the deuce side of the court (deuce), according to the trajectory of the stroke.

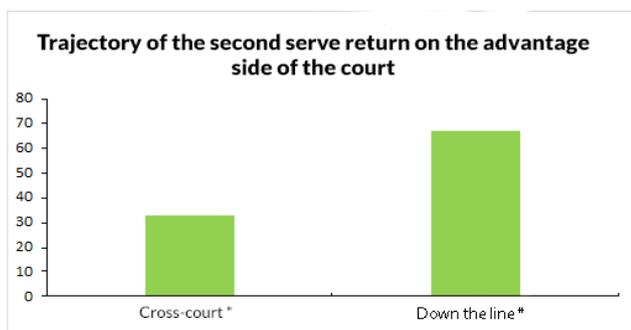


Figure 8. Percentage of second serve returns on the advantage side of the court (advantage), according to the trajectory of the stroke. * Significant difference ($p < 0,05$).

DISCUSSION AND CONCLUSIONS

First serve return

The main conclusions that can be drawn from the results regarding the first serve return are the following:

On the deuce side:

- Although the players do return more with backhands, this difference is not significant
- The players only hit a small number of inside-out forehands and inside-out backhands

- The players hit more down-the-line than cross-court returns

On the advantage side:

- The players mainly return with backhands
- The players do more crossed than down-the-line returns

Second serve return

The main conclusions that can be drawn from the results regarding the second serve return are the following:

On the deuce side:

- The players hit a large number of inside-out forehands and rarely hit backhands
- There are no differences in the percentage of down-the-line and cross court returns

On the advantage side:

- The players mainly hit backhands
- The players hit a larger number of down-the-line than cross-court returns

The fact players do not entirely focus on the first serve return seems logical, as the speed of the first serve is usually higher than the second serve (Reid, 2016) and therefore, the players have less time to react. In addition, on the advantage side, a large number of backhand returns indicates that the server mainly uses open serves. Moreover, the trajectory of the first serve return shows that players try to serve most of the time to the opponent's backhand. In this sense, for future studies, it would be advisable to establish another area that indicates which returns go to the centre of the court, given the importance of the return's trajectory (Hizan et al., 2011).

The data regarding second serve indicates that servers try to serve on the backhand of their rivals, but the rivals have the time to move to the right, whereas on the advantage side they do it less, because of the open trajectory of the serve. Regarding the trajectories of returns, on the deuce side they do vary a lot, while on the advantage side they tend to look for down-the-line options.

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[RECOMMENDED ITF TENNIS ICOACH CONTENT \(CLICK BELOW\)](#)



The hidden injury. Updating awareness of the latest research of concussion in tennis

[Alan Pearce and Janet Young \(AUS\)](#)

ITF Coaching and Sport Science Review; 78 (27): 10-12

ABSTRACT

This article updates coaches and tennis sports scientists on recent changes to the consensus statement for sports-related concussion. Specifically, the article provides new information that can be applied to tennis. While concussion in tennis is rare, head injuries in tennis do occur. It is important that in-lieu of medical staff available at training or tournaments, coaches and sports science practitioners are concussion aware.

Key words: concussion, injury, tennis, head injury

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Article received: 29 May 2019

Article accepted: 2 July 2019

INTRODUCTION

The issue of sports concussion continues to permeate throughout all sports. While of greatest concern in contact sports such as the football codes, this does not mean that athletes are immune to concussion injuries in non-contact sports such as tennis. Previous injury studies have reported that concussions in tennis are rare (Pluim, Staal, Windler, & Jayanthi, 2006). However, our previous article (Pearce & Young, 2016) highlighted a number of tennis case studies (e.g. Casey Dellaqua, Eugenie Bouchard, and Victoria Azarenka). Therefore, the issue is still of concern to tennis coaches and sports science staff working with players of all ages and abilities.

The Consensus Statement on Concussion in Sport has recently been updated (McCrorry et al., 2017). This statement has revised guidelines that are important for all coaches. The aim of this article is to present some of the new information contained in the Consensus Statement that tennis coaches and support staff can review and apply to their players. These include the evolving nature of the injury, courtside assessment protocols, and recovery. For basic information regarding concussion recognition and prevention of concussion during tennis training, the reader is referred to Pearce and Young (2016).

Concussion is an invisible and evolving injury

Most concussion symptoms appear quickly but also spontaneously resolve (McCrorry et al., 2017). However, concussion is an evolving injury whereby symptoms may not appear immediately, but sometimes after a few hours and over the course of several days (Elkington, Manzanero, & Hughes, 2019; McCrorry et al., 2017). Research is still aiming to understand why this happens. Latest evidence suggests that concussion affects the brain's physiology and if surpassing a threshold observable signs and symptoms will occur. This means that as the brain's physiological environment is dynamic and changes can occur over time (Giza & Hovda, 2001), it is important that once an athlete is suspected of concussion that he/she is monitored in case delayed symptoms appear. Even if symptoms disappear, coaches and support staff must remain vigilant, particularly if an athlete who has recently sustained a concussion reports he/she is not feeling well, or starts to look unwell, when increasing his/her exercise intensity. As reported by Victoria Azarenka,

"I was warming up in the gym...when I fell while running a sprint...I fell forward and hit my arm and head. I was checked by the medical team before I went on the court and they were courtside for monitoring. I felt worse as the match went on,

having a headache and feeling dizzy. I also started having trouble seeing and felt weak before I fell. I was taken to the hospital for some medical tests and have been diagnosed with a concussion" (Newman, 2010).

Protocols and process in applying the concussion protocol with suspected concussion

The latest Consensus (McCrorry et al., 2017) protocols for evaluation of athletes with a suspected concussion have not, in principle, changed from the previous statement (McCrorry et al., 2013). Firstly, it is important to note that players suspected of concussion should be removed from courtside for an assessment. Secondly, while signs and symptoms may appear obvious, only a licenced medical practitioner is able to formally diagnose a concussion. The reason for this is that there are overlapping signs and symptoms between concussion and other conditions such as heat stress/stroke, whiplash and facial injuries.

However, for the majority of sports participation (including tennis), a medical doctor is not present. Indeed, any health practitioner being present at training or a non-professional tournament is the exception rather than the rule. So what can be done in this situation? The consensus statement does provide the opportunity for non-medically trained personnel to recognise the signs of concussion for which there are two well-known instruments. The Concussion Recognition Tool (version 5) is a pocket-sized card that lists the 'red-flags' of concussion that require an ambulance; then if no 'red-flags' are apparent, simple steps to observe signs and symptoms in the individual (Echemendia et al., 2017). A second assessment that is gaining popularity is the King-Devick (KD) test. A simple



number reading tool that can be used on any tablet device, the KD has demonstrated good reliability and validity in recognising concussion (Galetta et al., 2016; Nguyen, King, & Pearce, in press; Rist, Cohen, & Pearce, 2017).

Return to play, rest is no longer best

The most significant change in post-concussion management in recent years is that complete rest is no longer the standard treatment after a concussion (McCrory et al., 2017). Emerging evidence suggests that after a brief period of rest, light aerobic activity where the level of the activity does not bring on or worsen symptoms is now encouraged. However, it is still agreed that vigorous exertion while an athlete is recovering is not permitted. This is because vigorous exercise intolerance may be due to autonomic nervous system dysfunction (Leddy, Haider, Ellis, & Willer, 2018). More recently research (Pearce, Tommerdahl, & King, in press) has shown central nervous system changes that may also contribute to exercise intolerance and general fatigue.

While it is difficult to present generic exercise guidelines, it is accepted that the Buffalo Graded test is a reliable and valid systematic evaluation of exercise intolerance post concussion (Leddy & Willer, 2013). Specifically, the test involves quantifying heart rate responses, allowing for the prescription of individualised exercise intensities below the heart rate that can bring on an individual's symptoms (Leddy et al., 2018). These authors suggest that having known heart rate concussion thresholds allows for precision dosage of exercise prescription thereby improving the efficacy of the recovery phase and potentially reducing the risk of persistent post-concussion symptoms (Leddy et al., 2018).

Recovery is not a linear path

Knowing when an athlete is ready to return to play is an immense area of interest, and knowing when to return to competition for tennis players is also very important. An update from the latest Consensus highlights the definition of recovery being a resolution of post-concussion symptoms and the individual showing normal motor (i.e. balance) and cognitive functioning (McCrory et al., 2017).

While it is generally accepted that a large majority of concussed athletes recover from clinical symptoms within four weeks, it is also appreciated that neurophysiological and psychological recovery can extend beyond the clinical timeline in some individuals. Moreover, recovery does not occur in a uniform manner; indeed, there is a heterogeneous recovery timeline for athletes. As reported by Casey Dellacqua,

At the time [of the concussion] I thought a couple of weeks, I'll be fine, I'll be sweet, because I had the championships coming up. But as the weeks went on, my symptoms got worse and worse.



I was in a fog for two weeks. I had headaches, I couldn't go on my phone or watch TV, I was so sensitive to light. And I was just sleeping for ages. And then I went to having almost insomnia where I couldn't sleep...So it was a combination of things. It was pretty scary at the time, because obviously with brain injuries I'd never experienced that and it's a very bizarre tennis injury (Trollope, 2016).

Juniors take longer than senior players for recovery

Concussion research in children (under 12 years) and adolescents (13-18 years) is limited, relative to research on concussion in adults. Therefore the latest guidelines have not been able to articulate specific protocols for concussion recovery management between children, adolescents and adults (McCrory et al., 2017). However, it is generally agreed that due to the developing brain, children and adolescents should take longer before returning to high intensity training and competition, compared to adults. Recently, it has been suggested that a child's return to sport program, including tennis, should be extended so that the child does not return to intense exercise less than 14 days from the resolution of all symptoms (Elkington et al., 2019)

Most importantly, children and adolescents should not return to training and competition, until they have successfully returned to school without exacerbation of symptoms (McCrory et al., 2017). During this time, however, it is appropriate that they undertake symptom-free exercise rehabilitation (Leddy, Baker, & Willer, 2016).

CONCLUSION - IMPLICATIONS FOR COACHES

Although the known dangers of head trauma in sport dates back over 90 years (Martland, 1928), the increasing interest in sports concussion is furthering our understanding of the injury, including tennis.

While concussion is rare in tennis (Pluim et al., 2006) it is important that coaches and sports scientists are not complacent about the issue. Recent case study examples have shown that tennis players can be affected for many months after a concussion injury (Pearce & Young, 2016).

The aim of this paper was to update new information gathered through scientific research, as well as translating the latest outcomes from the 2017 Consensus Statement that are applicable to tennis coaches. Although concussion science will continue to develop, it is important that coaches understand that no two athletes will react the same way following a concussion. Moreover, no two players will have a uniform recovery timeline. Low-intensity exercise that does not aggravate or worsen symptoms is now encouraged, compared to complete rest. Further, more conservative rehabilitation regime is required for children and adolescent players who have been concussed.

In all cases, if there is ever any uncertainty of a player being concussed or fully recovered, after being concussed, remember the mantra: if in doubt sit them out.

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RECOMMENDED ITF TENNIS COACH CONTENT (CLICK BELOW)



Developing shoulder-over-shoulder rotation in the serve

Elson Longo and Lucas Peres Rodrigues (BRA)

ITF Coaching and Sport Science Review; 78 (27): 13-15

ABSTRACT

Currently, high-level players have a tendency to perform serves with a strong vertical predominance. However, when looking at the basic technique of the execution of the serve, we notice that the movement is oriented horizontally forwards, with strong presence of trunk rotation in the longitudinal axis (twist). A crucial step in the development of the service is the transition from horizontal (twist) movement to the vertical. The objective of this article is to suggest exercises that help the transition from basic to more vertical mechanics.

Key words: shoulder over shoulder, trunk rotation, verticalization, service

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Article received: 10 March 2019

Article accepted: 28 March 2019



advanced (shoulder over shoulder) serves (Elliott et al., 2009). It requires careful coaching technical work to successfully promote this transition, where new and complex motor patterns must be incorporated by the player (Grosser and Schönborn, 2002).

The first step in this journey is to change the player's contact point, encouraging him or her to toss the ball slightly further to the left (or right if left-handed) (Roetert and Groppe, 2001). There are simple exercises to toss the ball using targets on the floor or on the fence that help the player in this task (Schönborn, 1998). The player will soon become used to the new release and consequently to the new point of contact. Once the new point of contact has been established, the new trunk rotation plane can be developed, along with generation and propagation of forces from the legs to the dominant shoulder (Ackland et al., 1994). This is the ideal time for coaches to refine the technique and be able to establish shoulder-over-shoulder rotation without the presence of rotation in the longitudinal axis, when increased power in the leg drive starts to manifest. It is known that shoulder-over-shoulder rotation differentiates slow from fast servers (Bahamonde, 2000). The following is an exercise that can help with this technical refinement, thus aiding in the "verticalization of the service".

INTRODUCTION

The basic technique of the serve, practiced by beginners, children and pre-adolescents, presents the dominance of trunk rotation in the longitudinal axis known as twist (Crespo and Miley 1999). In this type of serve the ball is tossed slightly forward off the body, releasing the ball 1 o'clock (for right-handed and 11 o'clock for left-handed players), the body rotates impacting the ball with forward projection (Borrel, 2012; Elliott et al., 2009), a movement that mostly occurs in the horizontal plane. After puberty, when the player begins to have greater ability to push upwards with the legs, mechanics increasingly manifest in the vertical, which we commonly call "verticalization of the service" (Longo, 2016). There are two main points in this transition:

1. The impact of the ball begins to occur slightly more to the left of the front leg, around 20 cm (Elliott et al., 2009), or between 11:30 and 12 o'clock;
2. The torso begins to rotate in the cartwheel axis, what we usually call shoulder-over-shoulder rotation (Elliott, Reid, and Crespo, 2003). This rotation begins immediately after the action of the legs, and it is completed in the air with the shoulder of the dominant arm (which moves the racket) higher than the other shoulder.

The contact point and trunk rotation plane changes are quite complex for the players, from a motor point of view. In a more detailed analysis, we found great differences in the kinematic behavior of the hip, trunk and in the forces transmissions from the legs to the trunk between the most basic (twist) and the most

PRACTICAL APPLICATIONS

When a player reaches puberty and begins to gain strength from the lower limb, he becomes able to increase his vertical velocity (Elliott et al., 2009). It is in this moment that shoulder over shoulder rotation gradually begins to prevail in relation to twist rotation. By changing the throwing of the ball and consequently the point of impact (slightly to the left), the necessary conditions are created for the further development of shoulder-over-shoulder rotation. However, players have the habit of turning the body (twist) since initiation in tennis. One of the most important elements to succeed in this transition is controlling the hip. The trunk will rotate if at any time the impulse of the legs twist the hips. It is important that while the legs extend, shoulder over shoulder is the only rotation present, allowing for greater speeds and vertical reach (Elliott, Reid and Crespo, 2003). Thus, the way the legs propel the hip is a key in the control of how the torso will rotate (longitudinal or cartwheel axis).

When the legs finish flexing and the player reaches the trophy position, we notice the dominant shoulder lower than the shoulder that threw the ball (Elliott et al., 2009). In order for the shoulder to go upwards, setting up the shoulder-over-shoulder rotation, it is critical that the back hip goes up as well. It is noticed that the back hip, in elite players, is 0.3 m/s faster (in vertical velocity) than the front hip (Elliott et al., 2009). This information indicates that the back leg is the protagonist in this process,

being responsible for the elevation of the back hip. Thus, for a successful shoulder-over-shoulder rotation, players should learn how to coordinate the leg drive. This impulse should push the hip, especially the back hip, up and forward (Elliott et al., 2009), exclusively, without causing any rotation in the longitudinal axis. Once the leg-hip assembly is moving upward and forward, with the back hip faster than the front one, shoulder-over-shoulder rotation occurs naturally as long as the ball is correctly positioned (Elliott et al., 2009).

An exercise proving to be very efficient in the motor learning pattern of the player, coordinating the leg-hip-trunk ensemble in the cartwheel axis, consists in using a vertically downwards force from elastic resistance in the dominant shoulder of the player, when the player bends his legs and is ready to drive.



Figure 1. Part 1 of exercise using resistance band to simulate correct shoulder over shoulder motion serve - the resistance bands pulls/keeps the shoulder and back leg/hip of the player down

The elastic band offers a resistance compatible with the strong leg, core and trunk muscles that will be used. The player holds the elastic tightly to the body, anchoring the end of it close to the dominant shoulder. From this moment on, the right arm will do nothing other than hold the elastic. With legs bent, heels slightly off the floor, spine aligned with the frontal plane, low dominant shoulder, non-dominant arm pointed upwards, practically vertically, the player will produce a force with legs, hip and trunk, raising the dominant shoulder as high as possible. During this action, it is intended that the hip and shoulders will not show any rotation in the longitudinal axis. The hip will be propelled upward, with the back hip higher than the front at the end of the execution. In addition, the hip should move slightly forward, moving away from the fence. The exercise does not have great amplitude, however it requires great strength of the player. At the end we see the player on his toes, legs fully extended, dominant shoulder higher than the non-dominant side, body straight and tilted to the side, and left arm close to the body.



Figure 2. Part 2 of exercise to simulate correct shoulder over shoulder rotation - Hip and shoulder move upwards past vertical level of other hip and shoulder, the player ends up on toes and there is zero to no twist.

By learning to perform this exercise perfectly, players end up understanding how the leg-hip-trunk ensemble should produce force to promote shoulder-over-shoulder rotation, overcoming the strong vertical force applied to the dominant shoulder.

However, there are several details that must be observed when players perform this exercise. The exercise seems simple, but in practice, players have some difficulty in performing it accurately. There are several systematic errors that appear:

1- Lack of coordination with the non-dominant arm.

The player extends the legs leaving the arm extended upwards. When beginning to extending the legs, the non-dominant arm should be brought down close to the body. The exercise helps players understand that, from the trophy position, the arm should only move after the beginning of the leg extension (two very common mistakes: lowering the non-dominant arm before pushing, moving the racket toward the nape of the neck before driving).

2- Moving the arm that holds the elastic (raising the elbow)

To overcome the vertical resistance from the elastic, players try to use the arm that holds the elastic. The force should come exclusively from the leg-hip-trunk assembly.

3- Raising the shoulder using excessive lateral flexion of the trunk

This is something that often happens by not achieving a good generation of strength, especially with the back leg, players tend to use only lateral bending forces of the trunk to raise the dominant shoulder.



Figure 3. Common issues - The player using the arm to pull against the resistance band, as well as using too much lateral flexion to raise the shoulder (without effective leg drive).

4- Rotation of hip and trunk on the longitudinal axis

This almost always happens in the first attempts, due to the automation of turning the body (twist) to serve.



Figure 4. Incorrect movement in the exercise – Rotation of hip and trunk rather than shoulder over shoulder movement.

5- Moving the hip laterally to the back side

This has a higher occurrence in youngsters who are still developing strength in the lower limb. When attempting to raise the shoulder the hip moves laterally towards the fence.

CONCLUSION

After players learn the exercise to perfection, there will be a neuro-motor reprogramming of how the leg-hip-trunk ensemble should act to potentiate the shoulder-over-shoulder rotation. It is suggested that players do 4 to 6 repetitions at a time. At the end of the series it is recommended that players immediately serve 9 to 12 times to apply the motor experience felt with elastic, creating the learning of the new pattern of execution. These protocols were elaborated through 8 years of application of this exercise, in different populations. One interesting variation is to apply vertical force downward on the dominant shoulder by replacing the elastic with a manual force from the coach (although ethical care must be taken to respect boundaries). Another option is to serve normally but standing only on the back leg. This exercise helps the introduction of the back leg as the protagonist in the generation of impulses in the serve.

It was noticed that this exercise, in addition to providing very useful body awareness to players of how the leg-hip-trunk ensemble should act for a better action of shoulder-over-shoulder rotation on the serve, helps generation of strength of specific biomechanics chain elements, improving the coordination and understanding of the movement, being an excellent catalyst in the process of verticalization of the service.

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RECOMMENDED ITF TENNIS ICOACH CONTENT (CLICK BELOW)



ITF report: the state of the game 2018

Jamie Capel-Davies and James Spurr (ITF)

ITF Coaching and Sport Science Review; 78 (27): 16-20

ABSTRACT

In order to fulfil its mission of protecting the nature of tennis and encouraging innovation and improvements, the ITF Technical Centre quantifies the parameters that describe the essence of the sport at the elite level, and thus constitute ‘the state of the game’. This annual report aims to establish how players, their equipment and the interaction between them are changing over time, to analyse the impact of these changes on the game and to contemplate the merits of any necessary counter-measures. Point length is a key metric of the nature of the game. Too many short points is generally considered unattractive. Low serve returnability can lead to short points, therefore serve returnability should be monitored and understood. Serve returnability is strongly dependent on post-bounce speed, serve angle and the proximity of the bounce to the centre serviceline or sideline. Taller players typically serve faster than shorter players and therefore generate higher post-bounce speeds, lower returnability serves and consequently more short points. The higher post-bounce speed of serves by these players can be reduced, increasing their returnability, by using a slower court and/or larger ball. A warning indicator signalling an excessive number of short points could be used to determine when regulation of equipment might be used to counteract the rise of shorter points. A more radical response would be to make the service-box narrower to increase the returnability of serves without impacting the speed of subsequent shots. .

Key words: elite tennis, technical, notational analysis

Article received: 13 June 2019

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Article accepted: 19 July 2019



- Point length is measured by the number of shots in a point. A match that consists mainly of very short points is undesirable as it risks being reduced to a serving contest. Conversely, a match that consists of too many very long points can become tedious. Point length is dependent on serve dominance, the players' (relative) ability and tactics, and ball speed.
- Point quality is defined by the 'style' of play, which includes the location of the players on the court (i.e. proximity to the net or baseline and sidelines), shot selection and frequency of winners and errors.
- Set length is measured by the number of points in a set and is dependent on the number of points in a game and games in a set. If the serve is dominant, then points and games will be short but there will tend to be more games in the set since neither player can break serve. If one player is significantly superior, both the games and sets will be short.
- Set quality is determined by the proportion of important points in the set (i.e. those points that strongly affect the outcome of the match). For example, break points are typically important points. Hence, set quality is also dependent on serve dominance and the relative ability of the players.

This report focuses on point length, examining the factors that influence point length, how they are changing over time and how they might be regulated if deemed necessary.

INTRODUCTION

In order to fulfil its mission of protecting the nature of tennis and encouraging innovation and improvements, the ITF Technical Centre quantifies the parameters that describe the essence of the sport at the elite level, and thus constitute 'the state of the game'. This annual report aims to establish how players, their equipment and the interaction between them are changing over time, to analyse the impact of these changes on the game and to contemplate the merits of any necessary counter-measures.

The following quotes were made two decades ago, but remain relevant and contextualise the purpose of the state of the game report:

"I think you have to look at what it will be like in 10 years down the road. I have seen some statistics that say that in one big final last year 54% of the points finished after the first two strokes. I don't think there's anything pretty to look at there." - Ivan Lendl.

"The big guys have an edge... We should not be frightened of changing the rules if it developed so that 90% of the top 50 were more than 6'6" (198 cm) and that finesse was being lost." - John Newcombe.

The following four metrics are believed to be key characteristics of the game that appeal to spectators and influence players' satisfaction and enjoyment:

POINT LENGTH

Point length is dependent on serve dominance. At the extreme, a winning serve has a point length of one. Successful serve and volleying have a point length of three. There is an inverse relationship between the length of a point and the impact of the serve on the outcome, as shown in figure 1. Understanding the returnability of a serve (defined as the probability it will be successfully returned 'in') enables the prediction of point length.

Serve returnability

Nearly 40,000 men's serves from Davis Cup matches played on acrylic and grass courts in the past seven years were analysed

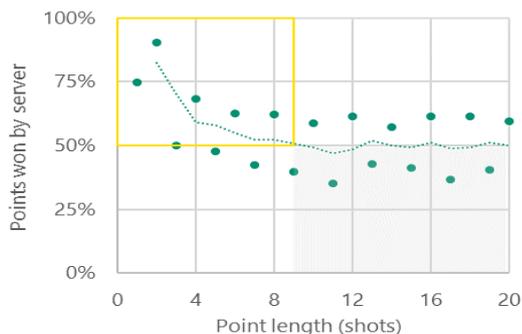


Figure 1. Percentage of points won by the server against point length in selected Davis Cup matches. Dotted trendline is a moving average of two periods.

to identify the critical determinants of their returnability¹. The serves were clustered into 80 groups of similar characteristics, based on 305 trajectory features (e.g. height of impact, initial speed). This method created a continuum of serve returnability (from the binary 'returned' or 'unreturned' outcomes). In doing so, the factors associated with high/low returnability could be isolated. Figure 2 shows the returnability of each cluster. The cluster returnability scores ranged from 22% (i.e. the types of serves in this cluster had a low probability of being returned) to 88%.

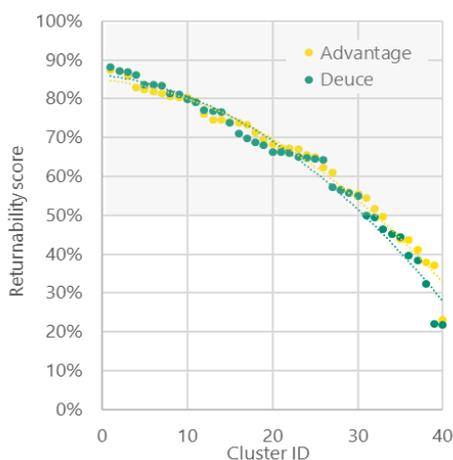


Figure 2. Returnability scores for each of the 40 serve clusters for the deuce court (green) and advantage court (yellow).

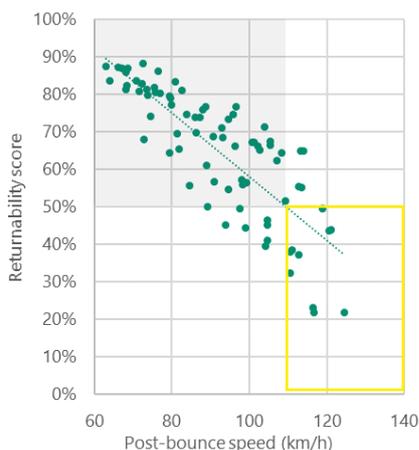


Figure 3. Returnability scores for each of the 80 serve clusters against post-bounce speed.

¹ The same analysis will be applied to women's serves in the Fed Cup.

Three key factors were identified using regression analysis: serve angle (i.e. the angle between direction of the serve and the position of the receiver), proximity of the ball bounce location to a long line (sideline or centre serviceline), and post-bounce ball speed. Figure 3 shows a negative linear correlation between post-bounce speed and returnability: as post-bounce speed increases by 1 km/h returnability decreases by almost 1%. Above a post-bounce speed of 110 km/h, the returnability score tends to be below 50%. A receiver facing a serve with a high post-bounce speed has less time to respond and must control the speed of the incoming ball. Several variables can contribute to a higher post-bounce speed, including a greater serve speed, a smaller ball (which generates less drag) and a faster court pace rating (CPR). A 1 km/h change in post-bounce speed is equivalent to around 2 CPR points.

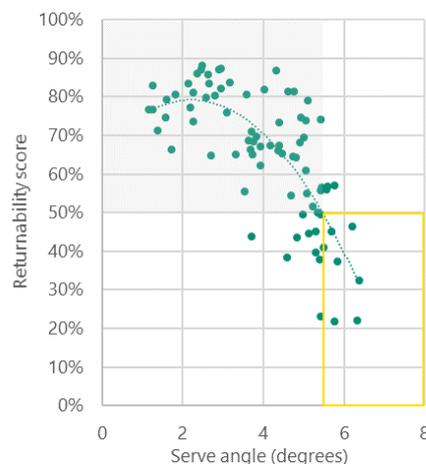


Figure 4. Returnability scores for each of the 80 serve clusters against serve angle.

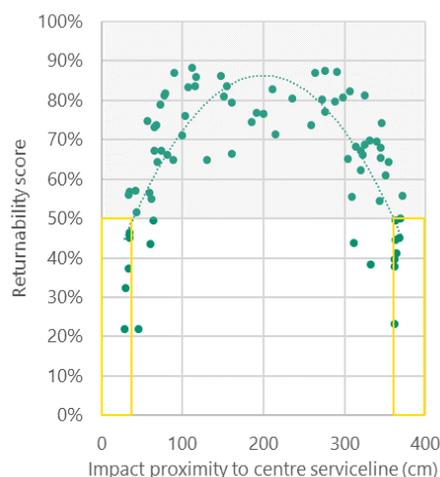


Figure 5. Returnability scores for each of the 80 serve clusters against proximity of the impact to the centre serviceline.

Figure 4 shows a non-linear relationship between serve angle and returnability. A receiver facing a serve with a higher serve angle has further to travel to reach the ball (and therefore less time to play their shot). Below a serve angle of approximately 3 degrees, there is not a strong effect of serve angle on returnability, but above 3 degrees the decrease in returnability is sharp. Above 5.5 degrees, the returnability score tends to be below 50%. Figure 5 shows a non-linear relationship between proximity of the bounce location to a long line and returnability. Returnability is lower when the ball lands close to a long line (within 40 cm). Receivers typically stand near to the midpoint of the advantage or deuce courts. Therefore, they have less time to play their return when the serve bounces close to centre serviceline or the sideline. Wide serves will typically have a larger serve angle and land close to the sideline, making them lower-returnability serves (provided they are not too slow).

When a server exploits all three critical determinants, serves have very low returnability. 'Super-serves' had a post-bounce speed of at least 110 km/h, a serve angle of at least 5.5 degrees and proximity to the centre serviceline of 40 cm, or less. These serves had a returnability of 20%, or one in five serves, which is enough to comfortably win a service game if produced consistently.

Player analysis

Figure 6 shows a positive linear correlation between first serve speed and player height. Taller players typically have a greater arm span, which produces a higher racket head speed (for a constant swing speed), and consequently a faster serve. Figure 7 shows a positive linear correlation between post-bounce speed and player height: faster serves, from taller players, result in high post-bounce speeds. Although serve speed cannot be moderated, post-bounce speed can be reduced through use of a larger ball and/or slower surface.

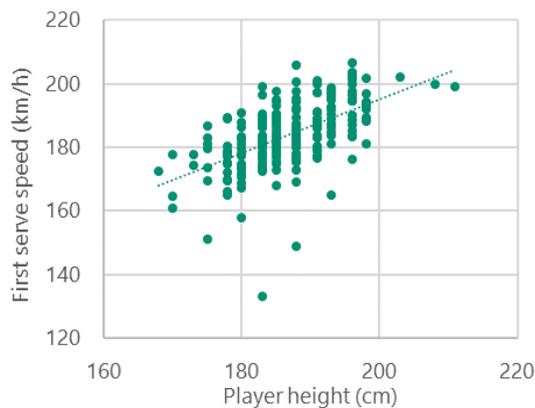


Figure 6. Average first serve speed against player height.

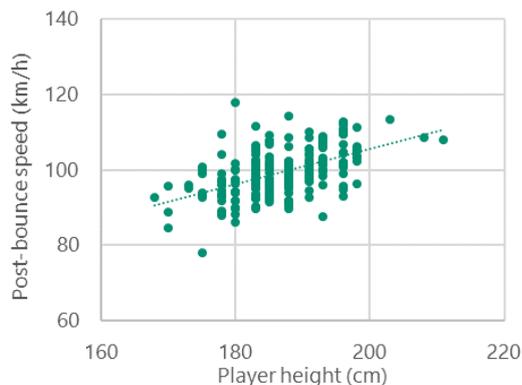


Figure 7. Average post-bounce speed against player height.

Figure 8 shows that the average heights of the top 50 women and men have increased since 2002, by 2 cm and 3 cm respectively. This increase in the average height of the men was due to the number of players over 200 cm tall who are currently active (prior to 2007 there were none) and a general increase in height across all 50 players (see figure 9). In 2002, women in the top 50 were 12 cm shorter, on average, than their male counterparts. This difference has remained reasonably consistent and is now 13 cm. The tallest woman in the current top 50 is the same height as the average height of the top 50 men (188 cm).

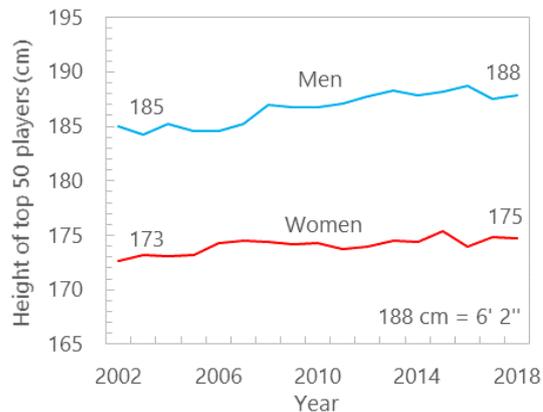


Figure 8. Average height of the top 50 women (red) and men (blue).

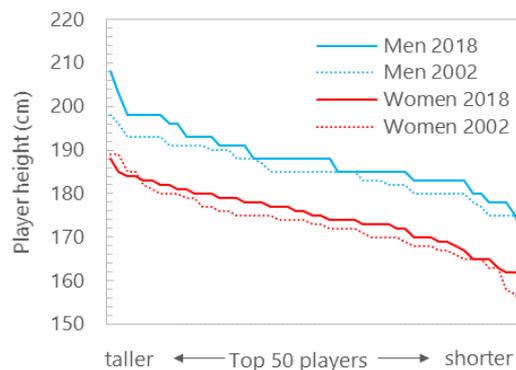


Figure 9. Individual heights of the top 50 women (red) and men (blue) in 2002 and 2018.

To summarise, taller players have an advantage over shorter players, because their additional height enables them to serve faster, and several of them have made it into the men's top 50 (possibly because of this edge). Player height cannot be capped, but the associated advantage of serve speed can potentially be attenuated by making changes to reduce post-bounce speed. Shorter players are less likely to be affected by these changes as they tend to serve slower in the first place.

Longitudinal analysis

The Grand Slam tournaments are a valuable gauge for assessing longitudinal changes in the sport as they have consistently strong draws, include a variety of surface types (with differing court pace) and inform many people's view of the game due to their high profile. Analysis of shot returnability and point lengths in these competitions is not currently possible due to a lack of data. In the absence of those data, other metrics, such as ace rates and serve points won, are used as proxies.

Figure 10 shows that, with the exception of the Australian Open, the incidence of aces has been stable at the Grand Slams. Higher ace rates contribute to lower serve returnability. The ace rates at Wimbledon have been roughly double those at Roland Garros. This demonstrates the influence of the speed of the court, as grass has the highest CPR of the Grand Slam surfaces and clay the lowest. Throughout the period analysed, men served aces at twice the rate of women. This would suggest that points were generally shorter at Wimbledon than at Roland Garros and that men's points were shorter than women's points.

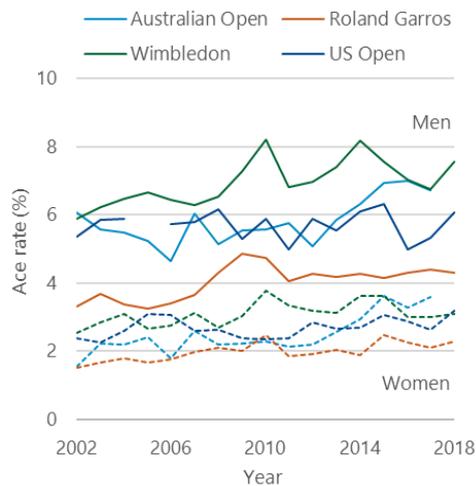


Figure 10. Percentage of aces per serve in Grand Slam singles matches.

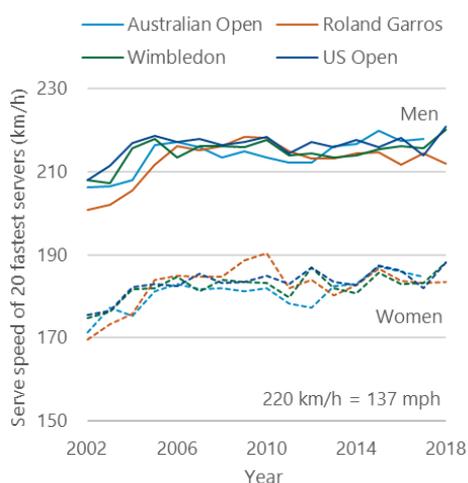


Figure 11. Average serve speed for the fastest 20 servers in Grand Slam singles matches.

Analysis of serve speeds at the Grand Slam events shows that the fastest serves of the top 20 fastest-serving men and women have increased since 2002 (see figure 11). However, most of this increase was between 2002 and 2005. Over the past decade, the top 20 fastest serving men served, on average, at 215 km/h and the women at 185 km/h.

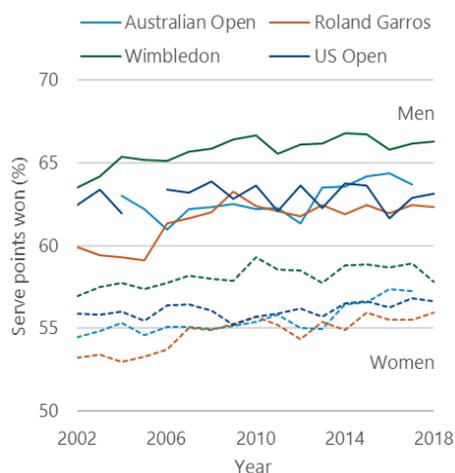


Figure 12. Percentage of points won on serve in Grand Slam singles matches.

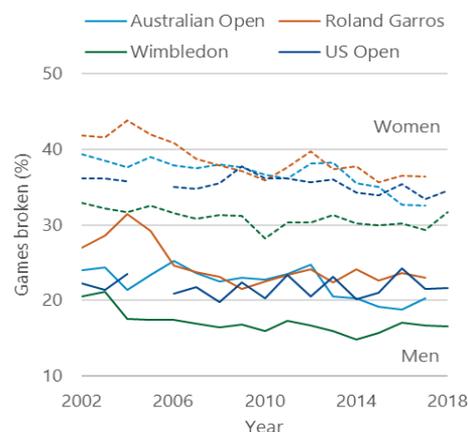


Figure 13. Percentage of games broken in Grand Slam singles matches.

Figure 12 shows that points won by the server is generally increasing over time and is highest at Wimbledon. It is therefore likely that returnability of serves at Wimbledon is lowest too (as indicated by the high ace rate). Remarkably, although the aces served at Roland Garros were less frequent (figure 10), the serve points won have been comparable to those at the US Open. Serve points won at the Australian Open have been gradually increasing for both men and women. One explanation for this trend could be a change in court pace over time, but this has not been verified. Figure 13 shows the percentage of service games broken each year, the decreasing trend in which is largely the inverse of serve points won. The serve has been less dominant in the women's game than it has been in the men's game. If serve returnability is low, the frequency of games broken is typically low. In the past 10 years, the average percentage of games broken in men's matches has been less than 25% at all of the Grand Slams and below 20% at Wimbledon.

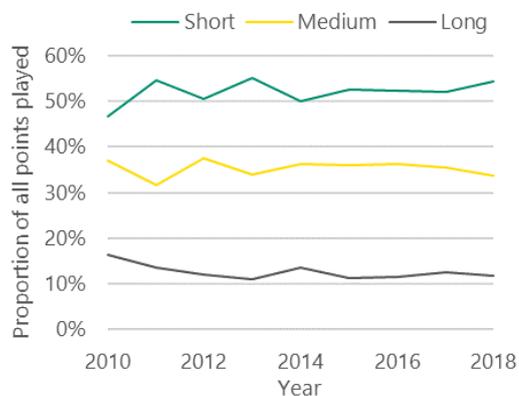


Figure 14. Percentage of short (less than 4 shots), medium (4-8 shots) and long (more than 8 shots) points played by men in selected ties in Davis Cup.

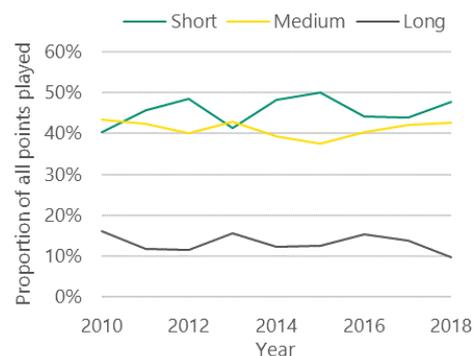


Figure 15. Percentage of short (less than 4 shots), medium (4-8 shots) and long (more than 8 shots) points played by women in selected ties in Fed Cup.

Figure 14 shows that typically more than half of points in the selected Davis Cup ties were 'short' (less than 4 shots) and just over 10% were 'long' (more than 8 shots). In the Fed Cup there were fewer short points and more 'medium-length' points (4-8 shots), as illustrated in figure 15. This is consistent with the predicted difference in point length between men and women for the Grand Slams. There was no identifiable trend of increasing or decreasing point length in the past 8 years in either competition. If it were to be agreed that short points are undesirable, it would be possible to establish a warning indicator at a particular level. For example, if the proportion of short points were to exceed that level in consecutive years, then action could be taken to reduce the incidence of short points. For instance, regulation could be introduced to increase the returnability of the serve. This could include use of slower court surfaces and/or larger balls. Alternatively, the size of the service box could be reduced by the creation of 'side servicelines' (see figure 16). This modification is more radical but would target the returnability of serves only and not affect other shots (which would be impacted if ball size was increased).

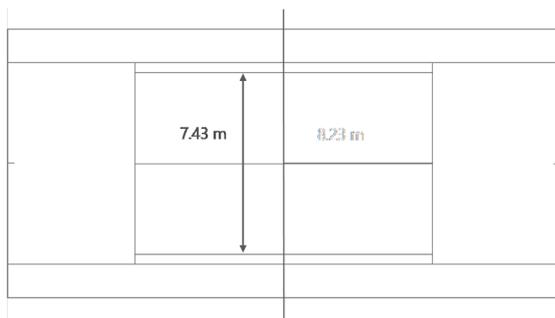


Figure 16. Court markings with the introduction of side service lines, which are on each side of the centre serviceline and run parallel to it 7.43 m apart from one another.

CONCLUSION

Point length is a key metric of the nature of the game. Too many short points is generally considered unattractive. Low serve returnability can lead to short points, therefore serve returnability should be monitored and understood. Serve returnability is strongly dependent on post-bounce speed, serve angle and the proximity of the bounce to the centre serviceline or sideline. Taller players typically serve faster than shorter players and therefore generate higher post-bounce speeds, lower returnability serves and consequently more short points. The higher post-bounce speed of serves by these players can be reduced, increasing their returnability, by using a slower court and/or larger ball. A warning indicator signalling an excessive number of short points could be used to determine when regulation of equipment might be used to counteract the rise of shorter points. A more radical response would be to make the service-box narrower to increase the returnability of serves without impacting the speed of subsequent shots.

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[RECOMMENDED ITF TENNIS ICOACH CONTENT \(CLICK BELOW\)](#)



The effect of tactical periodization and traditional periodisation on the technical effectiveness and intermittent resistance of university tennis players

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ITF Coaching and Sport Science Review; 78 (27): 21-23

ABSTRACT

In tennis, the high demand and unpredictable duration of matches lead us to examine which are the most efficient methodologies for the development of athletes' endurance. The objective of this study was to measure the effect of the tactical periodization method (game-based) and ATR periodización (traditional periodisation comprising accumulation, transformation and realization phases, i.e. based on training physical abilities in an isolated way) on the technical effectiveness and intermittent endurance in university players to establish the difference in effectiveness between the methods. 16 university tennis players participated in this study; they were then divided into two groups. Both training methods were applied to each group in a different order, measuring the intermittent resistance after each intervention with an intermittent recovery yo-yo test (level-1) and measuring the specific resistance and technical effectiveness by means of the set-test. The results show that the tactical periodization has a positive effect on technical effectiveness, achieving a greater number of successful strokes. This occurs without a lower performance in the intermittent resistance, whereas the ATR method achieves a greater ability to travel greater distances in situations decontextualized from the game. The results give insight to physical trainers on how training of resistance could be developed in game-based situations such as in the tactical periodization method, without neglecting specific resistance which primarily occurs best in isolated training of physical capacities such as with the ATR method.

Key words: specific resistance, tactical periodization, physical training, game-based

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Article received: 20 May 2019

Article accepted: 28 June 2019



INTRODUCTION

In a tennis match, power and speed can be seen in every action and a series of these game actions are usually carried out over very short periods of time (Vila, 2014). As a result, it is necessary to develop specific resistance, which in acyclic sports is intermittent for the short bursts of high intensity work and rest (Anselmi, 2012; Baiguet, 2011). Theories of traditional training maintain that the physical conditioning of players could be carried out in the same way as athletes' training (Tamarit & Frade, 2016). Traditional theories maintain that physical capacities must be trained independently and subsequently these will be transferred to the reality of the game through specific on-court training (Manso, Navarro & Caballero, 1996; Anselmi, 2012). New theories contradict these theories by assuming that the physical requirements of sports are specific and that physical capacities must be trained and manifested in the reality of the game to achieve an optimal development of fitness (Baiguet, Iglesias & Rodríguez, 2008; Tamarit & Frade, 2016; Seirul-lo, 1987). This contradicts the traditional model of training, where the reality of the game is said to be decontextualized. Some authors affirm that it is a loss of energy to train out of context and that energy used in training off the court could be better used in real situations of play with specific cognitive and affective components (Tamarit & Frade, 2016; Manso et al., 1996). Technical effectiveness is understood as the number of successes as a proportion of the total number of executions performed of a sporting skill (Acero, 2013). This technical effectiveness is a factor of utmost

importance in the evaluation of the performance of tennis players (Baiget, Iglesias & Rodríguez, 2008). The proposal of this study is to analyse by means of the ATR and Tactical Periodization methods, the technical effectiveness and the intermittent resistance in university tennis players.

METHOD

Participants

For this study of 16 university players, eleven young male university tennis players, on average 21.8 years old (S.D.: 2.13), 73.3 kg (S.D.: 8.52) and 174 cm tall (S.D.: 0.08), and five female university tennis players, on average 19.8 years old (S.D.: 2.77), 67.62 kg (S.D.: 9.29) and 161 cm tall (S.D.: 0.04), were taken as samples and voluntarily agreed to participate in the study. The sample was divided into group 1 and group 2. In order to avoid that the intervention methods and their order had a direct influence on the effects of each intervention, the interventions in the groups were applied in rotation as shown in table 1.

	First Intervention		Second Intervention	
	Method	Test	Method	Test
Group 1	PT	Post-test	ATR	Post-test
Group 2	ATR	Post-test	PT	Post-test

Table 1. Order of interventions for groups

Measures and Instruments

Measures of resistance and technical effectiveness were taken by means of the following tests:

- The Set-test (Specific Endurance tennis test), was used a ball throwing machine brand tennis 'Tutor Plus Player 3'. The test starts with a throwing frequency of 9 shots/min, increasing periodically to up to 13 shots/min until the exhaustion of the subject. The throwing speed was constant, and the test was carried out in stable environmental and wind conditions. The machine was adjusted so that the ball bounced alternately

in the determined zones. Players made alternating forehand and backhand topspin strokes adjusting their speed to the machine rhythm.

An objective evaluation of the technical effectiveness of the subjects was carried out by calculating the percentage of strokes and errors in the stroke, evaluating the precision and power of the strokes by means of lines marked on the court. The hits were successes or errors depending on precision criteria (falling on the target) and power (second bounce after a marked 'power' line). The total number of strokes executed is the sum of the errors and successes during the test. Heart rate was taken at the end of each period by means of the 'Polar H7 bluetooth' and the 'Polar Beat' software.

The test ended when the player could not hit two balls in a row or at the discretion of the examiner. Tennis players did not have to follow a prescribed style of technique or form in their strokes.

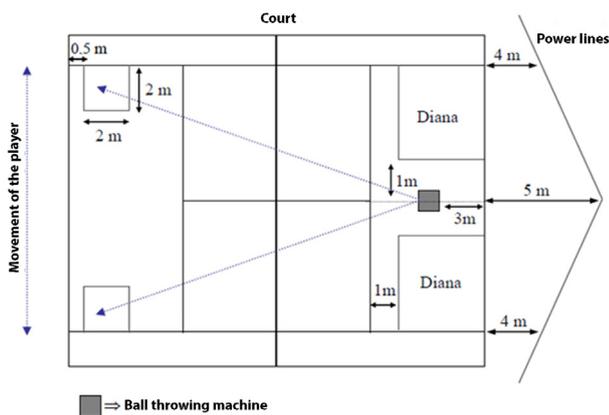


Figure 1. Set-test. Reference. (Baiget, Iglesias & Rodríguez, 2008) with modifications.

- The yoyo test of intermittent recovery features sprints of 2 x 20 mts between two markers back and forth. It is a progressive test with a speed increase given by the sound of the recording. Between each sprint there are rest periods of 10 seconds in an area of 2x5 mts. When subjects fail to reach the mark in time twice, the test finishes, and the time and distance of completion are recorded. It starts with 4 sprints at 10 - 13 km/h, increasing to 7 sprints from 13.5 to 14 km/h followed by a staged increase of 0.5 k/h until exhaustion. The test was carried out on a flat surface (figure 2). Distance travelled and vo2max data were calculated indirectly using the Bangsbo formula.



Figure 2. Yo-yo intermittent recuperation test level 1.

Intervention

We worked for 10 weeks. Each group performed both methods, and the duration per intervention was 5 weeks performing 2 sessions per week.

Intervention of the ATR method

The planning was developed in three stages. The first stage was the accumulation stage of 3 weeks of working continuous speed sprints; the two following stages consisted of a week each. The transformation stage consisted of sprints with changes in direction and in the realization stage, specific closed-situation drills on court were used. Volume was taken as the number of

meters and strokes made, and the intensity was taken to be defined by the relationship work - rest ratio. An example of a session is: speed sprints of 20mts x 9 sets with 13 sec. of rest, 15mts x 12 sets with 10 sec. rest and 3 exercises of 48 sets of 4 repetitions of strokes with 25 sec. rest.

Intervention of the tactical periodization method

In the intervention, the style of play proposed by the coach was taken into account, and macro-principles and subprinciples were developed to use each day. The principles established are geared towards all styles and levels tennis. We also take into account that the morphocycle pattern (training week in tactical periodization) includes a day of competition, which was replaced with a day of muscular contraction (resistance), as this is the day that represents maximum demand and similar characteristics to the competition. The game model was divided into a pro-set format without advantage and a system of direct elimination. From the model, principles were established for each phase of the game. In the attacking phase, the following principles were established: controlled aggressiveness and selection of intelligent strokes. During the neutral phase, the principles established were: striking a power-control balance and using a combination of strokes. Finally during the defensive phase, the principles established were: keeping the ball in play and counterattacking when under pressure. An example of an exercise of the session was: play from the baseline, trying to win the point from the red zone (sub-principle: control of the attack from the baseline). During a 27 minute period, 3 sets of 12 repetitions were executed in which a maximum of 6 strokes had to be hit, and resting for 15-seconds between repetitions.

Data Analysis

Descriptive analysis was carried out for the data. A one-way ANOVA design comparing test parameters was applied. In order to test the validity of the models, a study of the data was applied: normality, trends, etc. and a homocedasticity contrast (homogeneity of variances between the groups). The statistical software was SPSS, STATIXTIX 10.0. The level of significance for all tests was set at 5%.

RESULTS

Table 2 and Table 3 show the averages, standard deviation and differences at statistical and sports level in each test.

	T.P	A.T.R	Difference: (p) and units
Success	44.12 ±14.36	30.62 ±17.28	0.025* 13.5 strokes
Error	77.06 ±17.27	80.31 ±18.59	0.612 3 strokes
Total strokes	121.18 ±21.58	110.93 ±31.32	0.289 20.2 strokes
Technical effectiveness	36.33 ±8.57	25.98 ±9.23	0.002* 10.4 strokes
Cardiac strokes	175.77 ±4.74	176.32 ±5.52	0.763 1.4 bpm

* = significant difference (p < 0.05)

Table 2. Statistic analyse Set-test.

	T.P	A.T.R	Difference (p) and units
Level	13.4±0.55	13.7±0.67	0.153; (0.6 level)
Distance	410±85.79	485±103.15	0.032*; 75m
VO2Max	39.84±0.72	40.47±0.86	0.032*; 0.6ml/kg/min

* = significant difference (p < 0.05)

Table 3. Statistic analyse yo-yo test R.I. level 1.

Figures 3 and 4 show the comparison of the results between methods in the variables technical effectiveness in the set-test and distance in the yo-yo test.

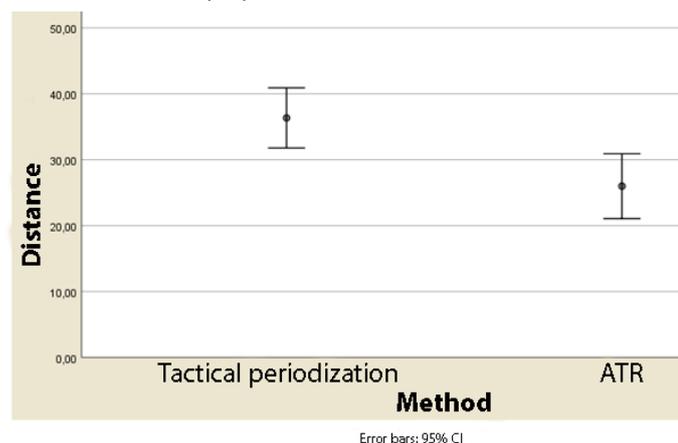


Figure 3. Differences between both tactical periodization and ATR methods for technical effectiveness.

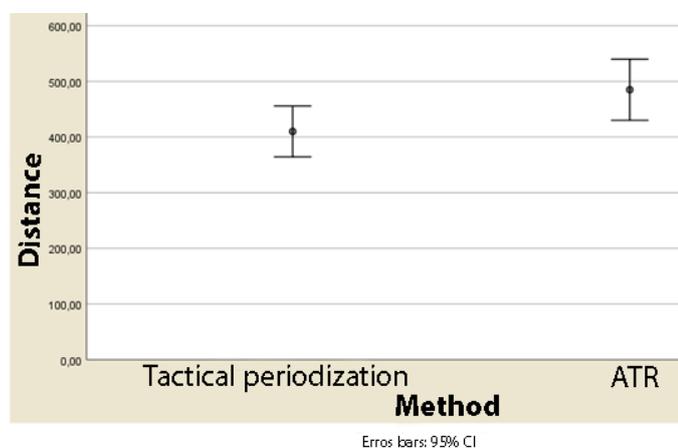


Figure 4. Differences between both tactical periodization and ATR methods for distance.

DISCUSSION

When we contrast the results obtained from the ATR and tactical periodisation methods we can observe that higher results were obtained for technical aspects (table 2, figure 3) in the tactical periodization model, which implies that it is a method more specific to training on court. The greater number of successes in the tactical periodization method is reflected in an increase in technical effectiveness. Therefore, this demonstrates that on-court training methods are effective in developing sports performance in tennis in conjunction with improvements in endurance (Srihirun, 2014). This is in line with research in other sports such as football and rugby, that have demonstrated equal development of physical aspects by developing them through play (Hill-Haas, Coutts, Rowsell and Dawson, 2009; Gabbette, 2006).

The results showed similar improvements in the physiological variables of cardiac frequency. and vo2max (table 2, table 3) thus showing improvements of physiological variables from both methods (Fernandez-Fernandez et al., 2011; Pialoux et al. 2015). We have to mention, that the values of our study are from university players and the levels of university athletes are below those of competitive athletes (Castagna Álvarez and Barbero, 2006). The ATR method obtained the greatest distance travelled (table 3, figure 4); however, when using Bangsbo's calculation (2008) on the yo-yo test results to assess the intermittent resistance capacity, we found that healthy active men can run 520mts and an elite soccer player can run 873mts which tells us that the athletes are at a similar level to a healthy person. We can infer that the ATR method has greater advantages in the parameter of distance travelled because a large part of the intervention is similar to the execution of the test, which is reflected in a higher distance covered.

CONCLUSIONS

The present study shows that there were differences between both methods during the five weeks of intervention. The method of tactical periodization showed greater improvements with the set-test in terms of technical effectiveness, due to a greater number of successful strokes. The ATR method showed greater improvements with the yo-yo test in terms of travelled distance. Both methods are each more adapted to the development of technical effectiveness and intermittent resistance, respectively. However, the method of tactical periodization offers greater improvements in intermittent resistance parameters under decontextualized game conditions. Physical trainers, when performing endurance work with their athletes, can implement tactical-focused training without neglecting the development of the specific endurance in tennis.

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[RECOMMENDED ITF TENNIS COACH CONTENT \(CLICK BELOW\)](#)



Mini-Ballschool for children 3 to 6 years old

Michael Ebert (AUT)

ITF Coaching and Sport Science Review; 78 (27): 25-27

ABSTRACT

Children are often missing fundamental movement skills and elementary ball skills when they get into the game of tennis. They have not learned to play yet but they are often specifically trained (with technique) from the very beginning. Learning is mostly done by practicing with instructions and corrections. The Mini-Ballschool for children aged 3 to 6 focuses on playing as the elementary form of learning.

Key words: Fundamental movement skills, ball skills, ABC of learning to play, implicit learning

Article received: 12 March 2019

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Article accepted: 1 May 2019



The Mini-Ballschool's basic principles and goals

There are three generally accepted key principles of the Mini-Ballschool. First, the goals need to be adapted to the children's developmental stage. Second, the contents are to ensure joyful learning. And third, the method chosen should be non-instructed "free play".

"Starting with children from where they are" is fundamental. This means that regard must be given to the movement competences toddlers and pre-schoolers usually have and that also the children's individual talents have to be taken into account (Roth, et. al, 2018). Two of the main considerations at the beginning were: What are kindergarten children really capable of? And what skills can be trained especially well?

The Mini-Ballschool defines three pillars, similar but also different to the "ABC of learning to play", the successful Ballschool Heidelberg programme for primary school children. Pillar A refers to the fundamental movement skills. Pillar B focuses on basic technical-tactical competences. Pillar C deals with basic coordination competences. The Mini-Ballschool's letters A, B, C become the "ABC of learning to play" for toddlers and pre-schoolers (Roth, et. al, 2018).

Pillar A: basic movement skills

At early toddler age, normally developed children have already gained fundamental movement skills, such as walking, running, or bouncing. Building on this, other skills such as throwing, hitting and kicking can be taught. Such fundamental movement skills are often also called phylogenetic skills. They are part of the repertoire of normally developed children at kindergarten age and are acquired across cultures (Roth, et. al, 2018). At pre-school age, another development step can be observed: all basic movement skills are increasingly optimized. The execution of movements is more stable (stability), can be better adapted to respective situations (variability) and requires less effort and attention (automation). At the age of 5 to 6 children are able to differentiate fundamental movement skills and to combine these skills fluently (Keller & Meyer, 1982).

There are seven basic movement skills that are taught and optimized with the Mini-Ballschool's pillar A. Mastering these fundamental movement skills is a required minimum for the successful participation in various physical-athletic activities, not only in playing. They are fundamental for the teaching of basic technical-tactical skills in pillar B. And also the acquisition of basic coordination abilities in pillar C would not be possible (Roth, et. al, 2018).

Table 1 shows the selection of the fundamental movement skills (pillar A) that focuses on the children's developmental stage and the central orientation in playing with balls.

INTRODUCTION

"Physical activity is an essential factor for the learning process, and has, together with cognition, a crucial function for the children's development. This is why a support of childhood competencies implies emphasizing physical activity in particular." (Ministry of Education and Cultural Affairs of Lower Saxony, 2005, p.18).

The importance of the first years for the development of the child cannot be given enough attention. Toddlers and pre-schoolers acquire the basis for the ability of learning and building relationships. Varied physical activity and playing are seen as the trigger and engine for the children's holistic development and education. In this regard, it is consistently said that it is in the children's nature to move and play (Club of Cologne, 2003, p.7).

THE "ABC OF LEARNING TO PLAY"

Training of general motoric competences and -skills

A comprehensive training of general motoric competences and skills is indispensable already at kindergarten. The Mini-Ballschool that was particularly designed for toddlers and pre-schoolers, makes a major contribution to a qualified training of basic motoric skills. The programme bears in mind that Mini-Ballschoolers are not specialists at this age but all-rounders and playing with different balls in that particular period of development poses enormous challenges. The curriculum combines many ideas and aspects especially of kinesiology, exercise science and sports psychology (Roth, et. al, 2018). The Mini-Ballschool that has been tested and proved successful in kindergartens and clubs for many years, is based on the concept of Ballschool Heidelberg that was founded by Prof. Dr. Klaus Roth in 1998.

Pillar B: basic technical-tactical skills

Preschool age offers children not only to learn and optimize fundamental movement skills, but also to learn first basic tactical and technical skills which are characteristic for many sports games. These skills, called ontogenetic skills, are based on the phylogenetic repertoire and are no longer learned by all children, but have to be acquired individually (Burton & Miller, 1998, p. 59).

But there is a clear no-go in the Mini-Ballschool as was well as in the Ball-School programme for primary school children. It is not about teaching specific technical skills and it is not about acquiring tactical knowledge for specific sports games. According to Wittgenstein (1960) the idea of the Ballschool Heidelberg is that all sports games are something like family members. Of course there are specific peculiarities but a number of technical and tactical motor tasks can be found across more or less all sports games (Haverkamp & Roth, 2006).

Table 1 shows the selection of six general technical-tactical skills (pillar B) that seem to be appropriate for the children's performance level and their learning ability.

Pillar C: basic coordination abilities

Coordination abilities refer to the control and regulation of movements. At toddler- and preschool age, the development of coordination abilities is, because of the early growth of the central nervous system, by far the most advanced. At the end of primary school age, children are already equipped with about 80% of their final performance level.

Table 1 shows the selection and the five concrete objectives of pillar C which follow current knowledge of kinesiology (see Neumaier & Mecheling, 1995; modified by Roth, 1998) and coincide with the typical criteria for coordination performances: speed, precision, complexity, organization and variability.

Basic movement skills (A)	Basic technical-tactical skills (B)	Basic coordination skills (C)
Catching	Determining the path of the ball	Time constraints/pressure
Stopping	Determining the movement towards the ball	Precision pressure
Bouncing	Determine the position/time of playing the ball	Complexity pressure
Dribbling	Positioning and orientation	Organisation pressure
Throwing	Assuring ball possession cooperatively	Variability pressure
Kicking	Recognising gaps and spaces	
Hitting		

Table 1: Mini-Ballschool's ABCs

The Mini-Ballschool's contents

"While playing a child is learning. However, it never plays in order to learn but because it finds enjoyment in what it is doing" (Zimmer, 2004, p.89). Children experience their environment, playing. The Mini-Ballschool's contents mostly consist of games and distinguishes three forms of playing (Roth, et. al, 2018):

- Free play (non-instructed)
- Playing with given (external) stimuli
- Task-oriented playing

Free play usually takes place in activity landscapes, where the placement of the different material allows children to play without any external instructions. Playing with given (external) stimuli means that Mini-games are integrated into imagery stories where the children play different roles. Playing task-oriented means that children receive precise instructions and also the tasks of the children are determined.

Playing is the elementary form of learning for children because of a neurotransmitter in the human brain: dopamine. Dopamine is released when a child, having completed a motor task, achieves better results than expected. Mini-games therefore have to effect mainly one thing: an unexpected sense of achievement, preferably as often as possible, as successful movement patterns are memorized by the human brain via dopamine (Beck, 2013a, b).

The Mini-Ballschool's methods

"Never help a child with a task at which he feels he can succeed" - Maria Montessori, 1870-1952..

Without doubt it is important that children discover and experience as many things as possible on their own. The natural form of playing in the Mini-Ballschool is free play which allows children to actively discover things. This approach supports children to create their learning processes on their own without being instructed or corrected all the time. Learning is possible by practicing (explicit learning) but it is also possible to acquire knowledge or skills incidentally without any effort (Roth, et. al, 2018). Learning without being conscious of the fact that we are learning at that specific moment is called implicit learning and is fundamental for the Mini-Ballschool's methods. This means that children do not have to gain conscious knowledge of solving general movement or tactical problems. Much more they have to increasingly act appropriately to the situation because of their acquired versatile playing-experience.

CONCLUSION

The Mini-Ballschool does not only contribute to an active childhood but its physical activities help to improve motor performances, health as well as the cognitive and psychological development. The contents and methods as well as the three pillars of the Mini-Ballschool that focus on the improvement of fundamental movement skills (A), basic technical-tactical skills (B) and basic coordination abilities (C), provide a unique and valuable guide for the work with children at toddler and preschool age. Equipped with these playfully acquired skills the step into tennis will be joyful one because they have learned to play before they get trained.



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[RECOMMENDED ITF TENNIS COACH CONTENT \(CLICK BELOW\)](#)



Plantar pressures differences between flat, slice and topspin serves

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ITF Coaching and Sport Science Review; 78 (27): 28-30

ABSTRACT

Analysis of plantar pressure during sport movement performance can provide significant information to athletes and coaches regarding sport performance and plantar loads. In tennis, the serve is one of the most difficult and most important strokes. The purpose of this study was to examine the plantar pressure differences between the flat, slice and topspin serves with the “foot back” serving technique on GreenSet tennis surfaces (tennis surfaces provided for professional and high-level play) of junior athletes aged 10 to 16. The results showed that the loads were higher on the rear (right) back foot of all the three serves. The Fmax was higher in foot toes for all types of serve and the peak pressure was higher in slice serve in the metatarsal forefoot region of the back right foot. The results showed that the technique applied, mainly to the footwork, varies between types of serves. Therefore, each type of the three serves has a different profile for plantar pressures and loads.

Key words: plantar pressures, serve, flat, slice, topspin

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Article received: 6 March 2019

Article accepted: 20 June 2019



and improve technique. Girard et al. (2010) concluded that, the type of serve and the stance style adopted have a significant effect on foot loading. Such findings might help improve mechanical efficiency of the serve.

To our knowledge, no data on plantar pressure distribution has been published for junior athletes for the tennis serve. The aim of this study was to measure and examine the plantar pressures, of junior tennis athletes during the three different serves, flat, slice and topspin, on green set surface with the “foot back” serving technique.

METHODS

Fifteen (8 males, 7 females) right handed tennis players, aged 10-16 years (three under-10 years, four under-12 years, four under-14 years, four under-16 years, participated in this study, that are playing in tournaments of the Hellenic Tennis Federation. All experiments were conducted on an outdoor GreenSet (same provider as professional tournaments) tennis court.

Instrumentation

Plantar pressures and vertical ground reaction forces were recorded using the footscan insole 2.39 system (RSscan International, Paal, Belgium). During data collection, the insoles were placed between the shoe and the surface of the sole on both feet. The data logger for storing the data was secured around the waist of the athlete's body. The data was transferred to a laptop at a sampling rate of 500 Hz.

Experimental set-up

Players performed a standardized warm-up which was followed by a 10-min of practice with each of the three serves. All serve trials were completed from the deuce court. Three successful trials were collected for each type of serve.

Data analysis

A regional analysis of the foot was performed on the recorded plantar pressure data by dividing the foot into four separate areas: Toes, Forefoot, Midfoot and Heel. Subsequently, the following parameters were determined for the whole foot and the four selected regions: maximum and mean force, peak and mean pressure.

INTRODUCTION

In tennis, the serve is recognized as the most important offensive weapon. According to Elliot & Colett (1993) the primary source of power is generated from the ground in the form of ground reaction force, which is emitted by the ground on the body as the server pushes against it.

According to Hutchinson et al., (1995), injuries that required physical or medical assistance were recorded for participants at the United States Tennis Association National Boys' Tennis Championships. The analysis of injuries showed a higher rate of lower than upper extremity injuries. When evaluated by injury type, strains and sprains were most common (71% of all injuries) with fractures and dislocations being rare (1.3% of all injuries). The lower extremity provided the majority of sprain type injuries with 87.5% of ligament sprains coming from the knee and ankle

In the back foot, the relative loads are distributed across the foot more equally and with a lower variability (smaller coefficient of variation) than in the front foot. This suggests that the back foot is a large base for force production and the starting point for the kinetic chain that goes from the ground to the leg, trunk, upper body segments, and finally the racquet (Bahamonde, 2000).

Analysis of plantar pressures, allowing documentation of a very powerful prognostic model in the initial functional ability of an athlete. Using the measurements and monitoring possible changes, positive or negative in the effort to improve technique, these data can greatly enhance improve athletic condition. The identification of the differences between the three types of serve may be the regulation of the intensity of training, the control of these variables in order to prevent the development of injuries

RESULTS WITH DISCUSSION

To our knowledge, no data on plantar pressure distribution during tennis movements have been published for tennis junior athletes. Furthermore, differences in plantar pressures between the flat, slice and topspin serves have not been previously investigated.

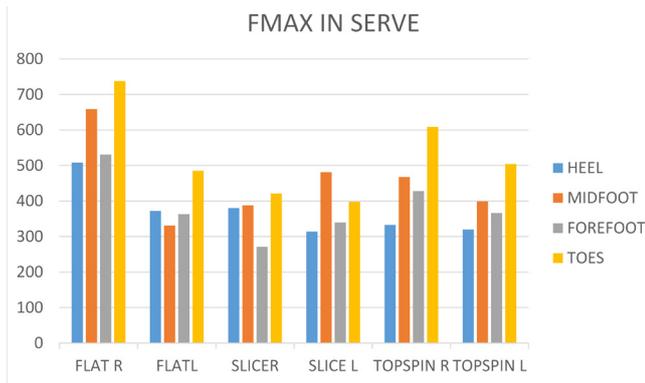


Table 1: Fmax (N) in flat, slice and topspin serves for different areas of the foot

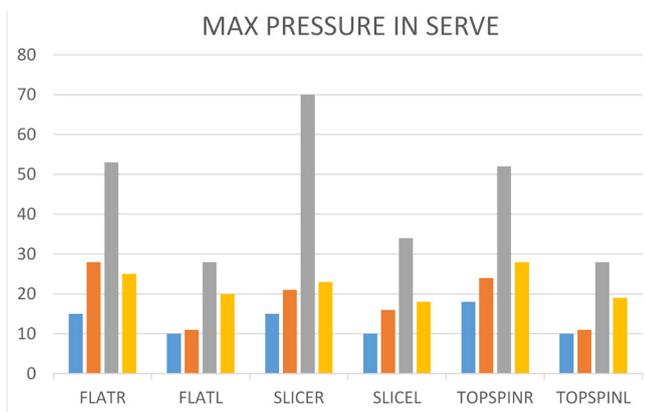


Table 2: Peak pressure (N/cm²) in flat, slice and topspin serves

The results showed that pressures and forces were higher on the rear (right) back foot of all the three serves. The rear leg provides the bulk of the upward and forward push, while the front foot provides a stable position to allow angular momentum development. Consequently, it appears that when right handed tennis junior athletes perform a tennis serve, the right foot displays highest plantar pressures, which results in the initiation of the sequence of serve movements as the foot contacts the ground, therefore subsequently contributing to the leg drive. So, coaches have to explain to their athletes for this phase of loading the importance of the rear foot, so they can achieve a better result of the upward and forward push and a better transfer of forces. The Fmax was higher in the toes for all types of serve, with the highest value observed in the flat serve, then in the topspin and lastly in the slice serve. This can be attributed to the usage of each serve, as the flat serve is frequently used as first serve, and, hence it is executed with more power and speed. After the toes, Fmax was higher in midfoot, then in forefoot and last in heels.



Peak pressure was higher in slice serve in the metatarsal forefoot region of the back foot, because of a higher knee bend ($\geq 20^\circ$) during the preparation phase of second serves as slice and topspin that are used (Lo, Wang, Wu, & Su, 2004). Also, the peak pressure was higher in the metatarsal forefoot region in all 3 types of serves in both feet. Finally, the peak pressures were higher in the back right foot in all 3 types of serves.

The results of the present study indicate that both the front and back foot are loaded differently for junior athletes, based on the type of serve. Coaches must understand the mechanical basis of the three types of tennis serves. So, when the junior players are performing tennis serves to be able to generate more racquet speed, they must work hard on the loading phase specifically at the time when the maximum loads are on the toes as this results in transfer of as much force as possible to the upper part of the body, thus optimising the kinetic chain.

PROPOSALS

Research in plantar pressure distribution when performing tennis movements should continue because it can help athletes of all levels (i.e. beginners or advanced players), to improve their skills, in cooperation with biomechanical knowledge, in order to improve performance, elicit better results and reduce injuries in tennis.

Finally, the study of lower limbs and plantar pressures is important for young tennis athletes, because this research will extend the knowledge about the technique and the type of service so that specific strategies for training, prevention and rehabilitation of injuries, are very important for the development of young athletes.

CONCLUSIONS

This study is the first that analyzes plantar pressures of the three different basic serves for junior athletes. The results showed that the technique applied to the footwork, varies between types of serves. The study of plantar pressure loads can effectively help athletes and coaches to produce better results allowing for a better start of the kinetic chain and allowing for leg drive that produces more powerful serves with better technique and fewer injuries.

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[RECOMMENDED ITF TENNIS COACH CONTENT \(CLICK BELOW\)](#)



Energy expenditure differences between the 5 types of modern tennis players

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ITF Coaching and Sport Science Review; 78 (27): 31-34

ABSTRACT

This project analyzes and categorizes the 5 types of modern tennis players: hard hitter from the baseline, counterpuncher from the baseline, all-around player, serve and volleyer, and attacking player, through the assessment of body hydration, energy expenditure, and match statistics.

Key words: tennis, energy expenditure, metabolic Holter, bioimpedentiometry

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Article received: 5 February 2019

Article accepted: 29 March 2019

INTRODUCTION

To the best of our knowledge, this is the first scientific study on the energy expenditure of the 5 types of player in modern tennis: hard hitter from the baseline, counterpuncher from the baseline, all-around player, serve and volleyer, and attacking player. In order to address our aim, we used 3 technological instruments: the "DF-50 Impedimed" bioimpedenziometer, the "SenseWear armband BodyMedia" metabolic holter and the "Score Analyzer for Tennis" smartphone app.

First, the bioimpedenziometer, a professional non-invasive instrument, was used to analyze the athletes' body composition and the distribution of intra and extracellular fluids. The analysis performed before the tennis match provided with the athlete's current state of health, while the analysis performed after the match, determined how much each athlete lost in terms of body hydration. Then, throughout the use of the metabolic Holter, applied to the triceps of the athlete's arm, we evaluated the total kcal consumed during the match at the best of 3 sets (2 sets out of 3). Furthermore, with the aid of the graphical analysis, we also observed the duration and time spent sitting at the changes of court, the intensity and the skin temperature of the athlete. To the best of our knowledge, except for the sport of volleyball (Woodruff, Meloche 2013) and rugby (Zanetti et al., 2014), the metabolic holter, has not been used as scientific tool to assess the energy expenditure of tennis players.

Finally, the smartphone app "Score Analyzer for Tennis", catalogued all the statistics of the matches, in order to determine the type of player analysed.

INSTRUMENTS AND METHOD

Subjects

We tested 50 tennis players, including 25 males and 25 females, aged between 14 and 28 years.

Their tennis activities ranged from 4 to 6 times a week with their ranking between 2.2 and 3.3 of the Italian Tennis Federation classification table.

Instruments

We used 3 scientific instruments:

1. The "DF-50 Impedimed" bioimpedenziometer to measure the impedance of the body to the passage to a low power high frequency electrical current (ca. 50 kHz). This provides accurate data on: the total lipid mass (triglycerides) of the body; lean mass consisting of skeletal muscles (about 40%); non-skeletal muscles; lean tissues and organs (about 35%); skeleton (about 10%); and,

total body water, which represents on average the 60-62% of the weight for men and the 56-58% for woman.

2. The Metabolic Holter "SenseWear armband BodyMedia" measures the body's physiological parameters: heat flow, galvanic skin response, skin temperature, room temperature proximal to the band, movements through a two-axis and six channels accelerometer. Furthermore, we used the "SenseWear BodyMedia 8.1" software to analyse the total energy expenditure, the active energy expenditure (METs above 3.0), the average METs, the number of steps and total distance covered, and the time spent sitting during court changes for each athlete.

3. The app for Smartphone "Score Analyzer for Tennis" was used to calculate and catalogue all the statistics of tennis matches: as for example, the number of winners, number of forced errors, number of unforced errors, number of aces, number of descents to the net, percentages of first balls "in" at the service, percentages of second balls "in" at the service, percentages of winning returns, etc..

Methodology

First, we collected the anthropometric data (personal data, family and personal history) for each tennis player. Second, we collected then the anthropometric data (weight, height, body mass index) for each of them. After a complete and accurate collection of all these data, the body composition was measured using the "DF-50 Impedimed" bioimpedenziometer. The distribution of total body fluids, both intra and extracellular, was then detected, thus providing the current health status of the athletes (see Fig. 1).



Fig. 1: The figure shows a tennis player undergoing the bioimpedenziometric exam before the tennis match, scheduled 15 minutes later.

Afterwards, each tennis player was asked to wear the metabolic holter "SenseWear armband BodyMedia" on the triceps of his left arm, to measure all the body's physiological parameters and, therefore, analyze the total energy expenditure (see Fig. 2).



Figure 2. The figure shows a tennis player with the metabolic holter "SenseWear armband BodyMedia", applied on the triceps of the arm, during a tennis training session.

With the metabolic holter placed, athletes were asked to play a training match (best of the 3 sets), observing all the necessary breaks and changes. During the matches, through the smartphone app "Score Analyzer for Tennis" installed on the researcher's smartphone, it was possible to archive all the statistics of the matches, to determine the type of player, and therefore allow for a direct objective analysis of the athletes' performances.

As soon as the matches were over, we took a second measurement of the players' body composition using the "DF-50 Impedimed" bioimpedentiometer) in order to determine the amount of body hydration lost throughout the match.

Each athlete performed the experiment 3 times, taking readings before and after each occasion, one for each month of activity (January 2018, February 2018, March 2018). The average of all three sets of readings was used for data analysis. All athletes were tested in outdoor facilities, with an average atmospheric temperature of 19° C. The matches were held on a single surface, clay, to compare athlete data on a single playing court; avoiding the potential confounding effects for results obtained on different tennis surfaces (grass, cement and synthetic).

Statistical analyses

Data were analyzed using the following measures: Hydration and Energy Expenditure (kilocalories).

Each measure was entered separately for Male and Female players into an Analysis of Variance (ANOVA) with Type of Players (hard hitter from the baseline, counterpuncher from the baseline, all-around player, serve and volleyer, and attacking player) as the within-subjects factor. Post-hoc analyses were conducted via pairwise comparisons (t-tests). We used Bonferroni correction for all comparisons.

RESULTS

The results point to 2 main categories: body hydration and energy expenditure per hour, which were split by types of player. In the next paragraphs, these are described separately for men and women.

Comparison of male body hydration level between the beginning and the end of a match

Type of Player - Males	Mean	Std. deviation	N
Hard hitter from the baseline	0.90	0.3536	5
Counterpuncher from the baseline	0.30	0.1225	5
All-court player	0.79	0.3317	5
Serve and volleyer	1.70	0.6124	5
Attacking player	2.00	0.2828	5
Total	1.12	0.7320	25

Table 1. Percentage points of men's body hydration lost by players during play

The ANOVA indicated a significant main effect of Type of Players [F (4, 24) = 17.801, p < .001]. To assess differences in the hydration level between Types of Players, pairwise comparisons were performed.

Difference between:		mean diff. (a)-(b)	Std. error	Sig.
Types of players - male (a)	Types of players - male (b)			
Hard hitter from the baseline	Counterpuncher from the baseline	0.600	0.237	0.201
	All-court player	0.200	0.237	1.000
	Serve and volleyer	-0.800*	0.237	0.031
	Attacking player	-1.100*	0.237	0.002
Counterpuncher from the baseline	Hard hitter from the baseline	-0.600	0.237	0.201
	All-court player	-0.400	0.237	1.000
	Serve and volleyer	-1.400*	0.237	0.000
	Attacking player	-1.700*	0.237	0.000
All-court player	Hard hitter from the baseline	-0.200	0.237	1.000
	Counterpuncher from the baseline	0.400	0.237	1.000
	Serve and volleyer	-1.000*	0.237	0.004
	Attacking player	-1.300*	0.237	0.000
Serve and volleyer	Hard hitter from the baseline	0.800*	0.237	0.031
	Counterpuncher from the baseline	1.400*	0.237	0.000
	All-court player	1.000*	0.237	0.004
	Attacking player	-0.300	0.237	1.000
Attacking player	Hard hitter from the baseline	1.100*	0.237	0.002
	Counterpuncher from the baseline	1.700*	0.237	0.000
	All-court player	1.300*	0.237	0.000
	Serve and volleyer	0.300	0.237	1.000

* = significant difference (p<0.05)

Table 2. Pairwise comparisons between different groups of male players for percentage points loss of hydration level during play

Men's energy hourly expenditure

The hourly energy expenditure among the various types of modern tennis player has proved to be quite homogeneous, especially for the men, with the attacking player category showing a slightly higher kilocaloric expenditure compared to the other types of players.

Type of Player - Males	Mean	Std. deviation	N
Hard hitter from the baseline	487	19.799	5
Counterpuncher from the baseline	455	29.428	5
All-court player	470	16.016	5
Serve and volleyer	478	15.297	5
Attacking player	525	24.779	5
Total	483	31.118	25

Table 3. Men's hourly energy expenditure (Kcal)

The ANOVA indicated a significant main effect for Type of Players [F(4, 24) = 7.296, p < .001]. To assess differences in the kilocalories between Types of Players, pairwise comparisons were used.

Difference between:		mean diff. (a)-(b)	Std. error	Sig.
Types of players - male (a)	Types of players - male (b)			
Hard hitter from the baseline	Counterpuncher from the baseline	32	13.748	0.305
	All-court player	19	13.748	1.000
	Serve and volleyer	9	13.748	1.000
Counterpuncher from the baseline	Attacking player	-38	13.748	0.120
	Hard hitter from the baseline	-32	13.748	0.305
	All-court player	-15	13.748	1.000
All-court player	Serve and volleyer	-23	13.748	1.000
	Attacking player	-70*	13.748	0.001
	Hard hitter from the baseline	-17	13.748	1.000
Serve and volleyer	Counterpuncher from the baseline	15	13.748	1.000
	Serve and volleyer	-8	13.748	1.000
	Attacking player	-55*	13.748	0.001
Attacking player	Hard hitter from the baseline	-9	13.748	1.000
	Counterpuncher from the baseline	23	13.748	1.000
	All-court player	8	13.748	1.000
Hard hitter from the baseline	Counterpuncher from the baseline	-47*	13.748	0.027
	All-court player	38	13.748	0.120
	Counterpuncher from the baseline	70*	13.748	0.001
All-court player	All-court player	55*	13.748	0.007
	Serve and volleyer	47*	13.748	0.027

* = significant difference (p<0.05)

Table 4. Pairwise comparisons between game styles for men's hourly energy expenditure (Kcal)

Comparison of female body hydration level between the beginning and the end of a match

Type of Player - Females	Mean	Std. deviation	N
Hard hitter from the baseline	1.40	0.2070	8
Counterpuncher from the baseline	0.60	0.1195	8
All-court player	1.00	0.1852	8
Total	1.00	0.3730	24

Table 5. Percentage points of female's body hydration lost by players during play

The ANOVA indicated a significant main effect for Type of Players [F (2, 23) = 42.000, p < .001]. To assess differences in the hydration level between Types of Players, pairwise comparisons were performed.

Difference between:		mean diff. (a)-(b)	Std. error	Sig.
Types of players - female (a)	Types of players - female (b)			
Hard hitter from the baseline	Counterpuncher from the baseline	0.800*	0.087	0.000
	All-court player	0.400*	0.087	0.000
Counterpuncher from the baseline	Hard hitter from the baseline	-0.800*	0.087	0.000
	All-court player	-0.400*	0.087	0.000
All-court player	Hard hitter from the baseline	-0.400*	0.087	0.000
	Counterpuncher from the baseline	0.400*	0.087	0.000

* = significant difference (p<0.05)

Table 6. Pairwise comparisons between different groups of female players for percentage points loss of hydration level during play

Female's energy hourly expenditure

Type of Player - Females	Mean	Std. deviation	N
Striker from the baseline	390	15.119	8
Counterattacker from the baseline	322	10.770	8
Complete all-court	275	8.177	8
Total	329	49.505	24

Table 7. Female's hourly energy expenditure (Kcal)

The ANOVA indicated a significant main effect of Type of Players [F (2, 23) = 195.008, p < .001]. To assess differences in the kilocalories between Types of Players, pairwise comparisons were used.

Difference between:		mean diff. (a)-(b)	Std. error	Sig.
Types of players - female (a)	Types of players - female (b)			
Hard hitter from the baseline	Counterpuncher from the baseline	68*		0.000
	All-court player	115*		0.000
Counterpuncher from the baseline	Hard hitter from the baseline	-68*		0.000
	All-court player	47*		0.000
All-court player	Hard hitter from the baseline	-115*		0.000
	Counterpuncher from the baseline	-47*		0.000

* = significant difference (p<0.05)

Table 8. Pairwise comparisons between different types of female players for hourly energy expenditure (Kcal)

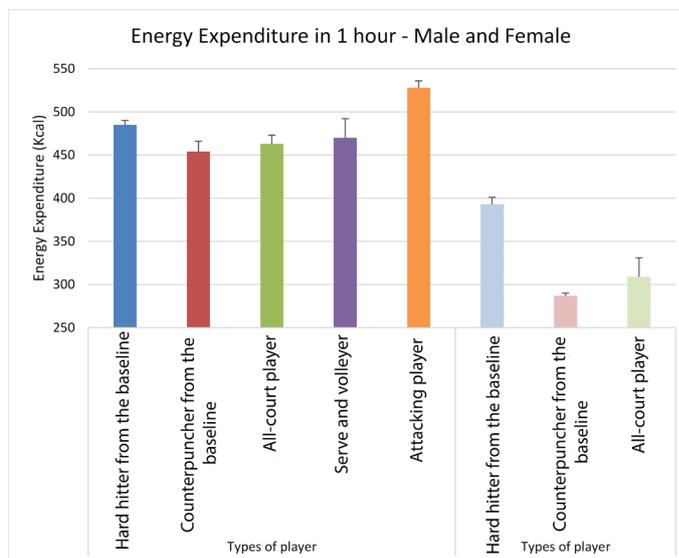


Fig. 3: The graph shows the comparison of the energy expenditure (kcal) hours during the matches between the various types of player, divided between males and females. The bars represent the standard deviation from the average.

CONCLUSIONS

The present work scientifically highlights for the first time the energy expenditure in the 5 types of player in of modern tennis players, for both males and females. To this aim, we measured, analyzed and then evaluated the differences in the hydration level between the beginning and the end of a match, the different energy consumption per hour and we provided each player with a specific type of training scheme.

In particular, those players that evidenced a high energy expenditure level in the first measurement (January 2018), received detailed indications on how to improve their nutritional lifestyle, physical preparation and tactics used during the match,

aiming to improve their overall performance. For instance, to the counterpuncher from the baseline who showed high energy expenditure levels, we suggested two strategies: the first pointed to a radical change in the athlete's physical preparation and nutrition habits, so as to achieve better performance in strength and resistance; the second strategy pointed to a variation of the style of play, including more variability so as to increase the number of winning shots.

It is worth noting that these strategies have been addressed taking into account technical, tactical, physical, mental aspects, and, as such, were customized for each subject based on the athlete daily training and nutritional lifestyle.

The second and third measurements (February 2018 and March 2018) showed a general improvement of the player abilities, succeeding in concluding the exchanges during the match with more possible solutions and with a lower energy expenditure.

Moreover, the results evidenced a significant difference in the body hydration level measured at the beginning and the end of each match, for both males and females, which had a strong impact on the match results. In fact, the 75% of players that won a match showed a negative variation of total body fluids equal to <1%. This result corroborates the importance of hydration before, during and after a match or tennis training.

Furthermore, as evidenced in the results section, female in all court players showed a reduced energy expenditure (ca. 200 Kcal) compared to male players belonging to the same category in 1 hour of matchplay (see Fig. 3). This underlines the importance of customizing a specific physical and nutritional model for each player, thus pointing to a general improvement of the athlete health and lifestyle.

In conclusion, these findings provide tennis coaches with a strong platform from which to guide their athletes in terms of different game styles, based on the analysis of body measurements and tactical data, and considering individual skills and attitudes of the athlete towards the chosen style.

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A practical proposal for the development of rhythm in tennis players

Santiago Micó and Rafael Martínez-Gallego (ESP)

ITF Coaching and Sport Science Review; 78 (27): 35-37

ABSTRACT

The importance of training coordination for the development of young players is a well-established area of research. However, rhythm, despite having a crucial importance in tennis, is one of the coordinative capacities less studied and therefore, there is a lack of information that could allow coaches to design coaching sessions that focus on these capacities. This article highlights the importance of rhythm in tennis, and also presents a series of general exercises (without the use of a specific tennis equipment), special exercises (with the use of specific tennis equipment) and specific exercises (whilst rallying or playing) aimed at the training of these coordinative capacities.

Key words: coordination, rhytmn, training, drills, tennis specific

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Article received: 18 June 2019

Article accepted: 10 July 2019

INTRODUCTION

The importance of the development of coordination, and more specifically of coordinative capacities – particularly in the earlier years of development–, is widely established. In fact, coordination capacities allow players to control, improve and give pace to movements and actions, which play a major role in the development of movement techniques (Reid et al. 2009).

Within these coordination capacities, based on Meinel and Schnabel classification (2004), a total of seven capacities or skills can be distinguished: coupling, spatial-temporal orientation, reaction, kinesthetic differentiation, adaptation, transformation and balance and rhythm. The present article focuses on this last capacity, given its importance within tennis, as will be seen below.

Fernández et al. (2012) define rhythm as the capacity to sense and reproduce a rhythm imposed externally, as well as the capacity to use the motor activity itself following an internalized rhythm. Therefore, a distinction can be drawn between: regular rhythm, in other words, rhythms where the cadence or sequence is equal; and, the irregular rhythm, where there are changes of rhythmic sequences.

Meanwhile, Reid et al. (2009) define rhythm as the ability to capture a cadence acquired from an external source and reproduce it in motion.

Lastly, based on Thaut (2005), practicing rhythmic activities not only regulates our movement but also provides opportunities to execute that movement more efficiently and more precisely. Therefore, training sessions with motor tasks with different tempos, intensity and rhythm offer the opportunity to improve these fundamental skills as well as motor abilities (Gallahue, 1982).

RHYTHM DEVELOPMENT

Firstly, despite the strong implication of rhythm and timing structure in motor control, studies in sports are limited (MacPherson & Collins, 2009), with insufficient research or proposals of exercises referring to the specific training of rhythm in sport (Sögüt et al. 2012).

Sögüt et al. (2012) conducted an 8-week study aimed at analysing the effects of rhythm training in tennis in which a total of 30 students were divided into 3 groups: the tennis group (control), the group of general rhythm training and the group of specific rhythm for tennis. The results showed that the participants of the group that trained rhythm made progress in their level of tennis, improved their consistency in forehands and their rhythmic competence. Moreover, the results also showed

that the participants displayed higher values in rhythm in rapid tempos compared to slow tempos. This suggests that higher tempos should be emphasized in our proposal.

Finally, Zachopoulou y Mantis (2001) studied the role of rhythm training in the execution of the forehand in tennis in participants over 10 weeks. The participants, between the ages of 8 and 10, were divided into 2 groups: control and experimental, and the experimental group showed a major improvement of the rhythmic precision in rapid and slow tempos. Moreover, the consistency of the forehand improved after the training period.

PROPOSAL OF EXERCISES

Below is a series of exercises aimed at the work of the coordination skills, emphasizing the improvement of the specific rhythm for tennis. In all the proposed exercises, the software Tempo Perfect Metronome v 5.00 (NCH Software) was used to establish the desired rhythm, establish rhythmic sequences and change them manually. Figure 1 is a screenshot of the software, in which a tempo of 92 bpm was established and for every 5 main beeps (henceforth beep A), there is a shorter, sharper one (henceforth beep B) . Moreover, the programme allows to vary the rhythm manually with the computer, which can be useful for allowing students to readjust their motor actions.

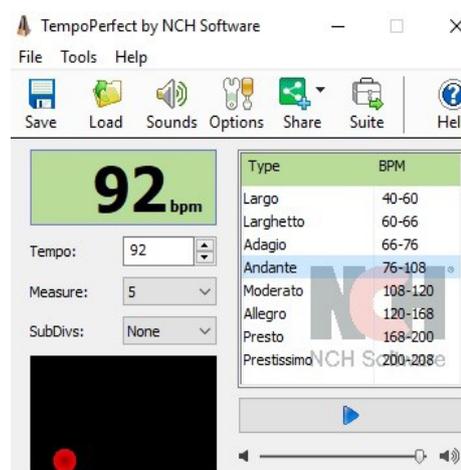


Figure 1. Software Tempo Perfect Metronome v 5.00 (NCH Software)

The exercises are divided into: general (without specific tennis equipment), special (with tennis equipment) and specific (whilst rallying or playing tennis).

General:

Exercise 1: Warm up and overall mobility using the rhythm of the metronome (shift, turn, jump ...).

Exercise 2: All the players, sideways in a line, have to move the foot closest to the line on the rhythm of the metronome. Alternative: they have to move both feet, one after the other and perform a cognitive exercise (addition, give the name of a country or a city) while following the marked tempo.

Exercise 3: Standing over the line, players have to open and close legs at the rhythm of the metronome. Alternative: they must pass from one side of the line to another while throwing a ball between hands as the exercise goes on.



Exercise 4: While skipping, players have to pass the foot on the left and on the right of the line following the sequence of the sounds A or B. Alternative: when hearing beep B, they have to turn their position at 90 degrees on the right and continue to pass the indicated foot.

Exercise 5: Place 2 hoops diagonally above and behind the player, and upon hearing the sound sequence, players have to put their feet in the upper or lower hoop.

Exercise 6: Using a coordination ladder, players have to perform a footwork pattern at the rhythm of the metronome. Alternative: they have to pass a hoop from hand to hand or bounce a ball following the tempo either with their feet or hands and upon hearing the two sounds A and B, and stick out the left or right foot as indicated.

Exercise 7: Using different songs, students have to adapt their motor actions to the tempo, either with their feet or hands.

Special:

Exercise 8: Each student with a ball must throw it and catch up at the rhythm set by the metronome. They must bounce it (without holding it) or throw it at the rhythm of the metronome. Alternative: they must perform the same exercises with the racket, i.e. hit the ball against the ground or upwards, with the beat. Sound A is equivalent to hitting the ball against the ground, and sound B, to hitting it upwards.

Exercise 9: Each student with 2 balls, one in each hand, follows the sequence of two sounds. Each sound is the equivalent of the bounce of the right or left hand. Alternative: players have to throw a ball against a wall with the left or right hand following sound A or B.

Exercise 10: In pairs, facing one another at a distance of 2 or 3 meters, with a ball for each student, players have to perform alternate passes to the rhythm of the metronome. Alternative: they have to throw the ball with their left hand on beep A or with their right hand on beep B; or, beep A bounce pass, beep B pass upwards without bounce.



Exercise 11: Using the coordination ladder, players have to maintain the intensity of the rhythm of the feet (any exercise) carrying the rhythm with 1 ball that we are throwing, throwing upwards, passing it from hand to hand. Alternative: players have to perform the same exercise with a racket.

Exercise 12: Using the coordination ladder and each student holding 2 balls, one in each hand, players follow the sequence of two sounds. Each sound is the equivalent of the bounce of the ball in the left or right hand.

Specific:

Exercise 13: Players have to play at the rhythm set by the metronome, having to get closer to the net to volley, or to play from the back of the court, depending on the rhythm.

Exercise 14: Set the sequence of beeps and play with the left hand upon hearing the beep B in the service box. Alternative: with beep b) we do not perform the action, instead resetting the motor action.

Exercise 15: Set the sequence the players must play with topspin on beep A and hit with topspin on the player's own side of net first on beep B. Alternative: beep A, play with a short slice, beep B, play with topspin; beep A play with bounce and beep B, play a volley.

Exercise 16: Set tempos that students have to match whilst rallying from the back of the court, always looking for consistency in their hitting.

Exercise 17: Whilst listening to a song, students must find the tempo of the song and then coordinate their hitting.

CONCLUSIONS

The development of coordinative capacities plays a very important role in the acquisition of basic motor skills, especially in earlier years, and therefore it plays an important role in the objective of achieving effective long term development of players. In this motor literacy, rhythm plays a fundamental role in achieving a coordinated movement which is appropriate to different situations. Although there are few studies that focus on the work of rhythm in tennis, both coaches and physical trainers should be aware of the importance of this coordinative capacity. This practical proposal provides basic initial information to coaches and physical trainers for basic training of rhythm with their players.

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ISSN: 2225-4757

Foto Credits: Gabriel Rossi, Paul Zimmer,
Sergio Carmona, Mick Elmore, ITF

ITF Coaching and Sport Science
Review:
www.itftennis.com/coaching/sportsscience

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The Tennis Anti-Corruption Program (TACP) is in place to protect the integrity of our sport and protect you as coaches and all those within tennis against corruption and betting related offences. This document provides a summary of the anti-corruption rules, for the full list please visit www.tennisintegrityunit.com.



Coaches

Betting

- ✗ **DO NOT** bet on any tennis event, at anytime, anywhere in the world or assist others to do so
- ✗ Betting companies **MUST NOT** sponsor, employ or provide any other benefits to you in exchange for yours or your player's services

Match Fixing

- ✗ **DO NOT** ask or help any player to fix the outcome or any aspect of a tennis event (this includes spot fixing of points, games or sets or attempting to manipulate the draw in any way)
- ✗ **DO NOT** ask or help any player to perform below their best efforts in a tennis event

Inside Information

- ✗ **DO NOT** share non-public, sensitive information about a tennis event or a player for betting purposes with anyone
- ✗ **DO NOT** offer to provide any non-public, sensitive information to anyone in exchange for money or any benefit

Wild Cards

- ✗ **DO NOT** accept or give money or any form of compensation in exchange for a wild card on behalf of or for the benefit of a player, whether or not the player has knowledge of your actions

Reporting Obligations

- ✓ **YOU MUST** report any knowledge or suspicions of corruption to the TIU
- ✓ **YOU MUST** inform the TIU as soon as possible if you are approached by any person who offers money or any benefit to influence the outcome or any aspect of a tennis event or asks for inside information
- ✓ **YOU MUST** cooperate fully with investigations conducted by the TIU, which may include being interviewed or providing your mobile phone, other devices or relevant documents



You have a responsibility to ensure that you and your players are aware of and comply with the rules of the TACP. As a coach you are covered by the TACP and will remain covered for two years following the last event you received accreditation to.



If you break the rules, or conspire to do so, you could face a maximum fine of \$250 000 and a lifetime ban from participating in, or attending tennis events.

For further information, to report corrupt activity or if you have any questions download the TIU app or contact us using the links below:



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Dear CSSR Reader,

We are pleased to announce the launch of the online ITF Academy - an online educational resource which provides information and education; and enhances the certification pathway.

The ITF Academy is available to National Associations, coaches, players, fans, parents and anyone interested in tennis or sport in general.

The ITF Academy will launch over three phases between 2019 and 2020:

- Phase 1, March 2019:** The Information and Education phase will see the release of online short courses and a brand-new iCoach library within the ITF Academy.
- Phase 2, from July to December 2019:** The Certification phase will see the launch of blended learning (online combined with face-to-face delivery) certification courses - the ITF Play Tennis course will be the first course to be made available, followed by the ITF Coaching Beginner and Intermediate players course.
- Phase 3, through 2020:** The Continuous Professional Development (CPD) phase will build on the already available short (online) courses through automated tracking and calculation of CPD credits/hours.

Head to the ITF Academy to browse through the courses as well as the latest iCoach content from around the world.

Please contact our coaching team at coaching@itftennis.com if you need more information on the ITF Academy, or follow the following link to register:

www.itf-academy.com

