

# Training Recommendations based on Match Characteristics of Professional Singles Tennis

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## Abstract

The science of training in professional tennis has significantly increased over the past decades in response to various factors, including increased depth in standard, commercial and competitive pressures, and heavier tournament schedules. In order to be competitive at this level, players must spend many hours of physical conditioning "off court" to complement their hitting and match practice. These areas are not only important to maximizing competitive performance but also assist to reduce injuries that may result from the higher stresses of play and the demanding professional tour schedule. Necessary modifications in technique are often difficult to make since the competitive phase lasts almost an entire year, with any missed tournaments resulting in failure to achieve valuable points for rankings. Thus, the principle of specificity should be employed in every training program, to ensure maximum effectiveness and efficiency. The principle of specificity states that training is of the greatest benefit when it reflects the requirements of the actual performance. Consequently, optimal competitive tennis performance would be achieved through a training program that is similar to the characteristics and demands of match play. A number of previous studies have investigated the match characteristics of professional singles tennis. This paper discusses training applications based on these findings in relation to the principle of specificity.

**Key Words:** Tennis; specificity; physical training; match analysis; performance.

## Introduction

Tennis is among the world's most popular and professional sports. Over the past decades high participation rates, in addition to large competitive and financial pressures on players, have raised overall performance at the elite level. Improvements in performance, particu-

larly at the elite level, largely depend on applying scientific knowledge to increase the quality of training programs.<sup>1</sup>

One aspect of the improved overall performance in professional tennis relates to the significant increase in the importance of a player's physical characteristics. As the demands of professional tennis have increased, a player's physical capabilities and attributes have a larger impact on their level of success. Fitness training has therefore become a major focus in players' attempts to enhance stroke power and court movement in the pursuit of a competitive edge.

Furthermore, to maintain rankings, players compete in more tournaments annually than in previous years, hence must be in optimal physical condition to cope with the stresses imposed on the tour. A study has found that 50-90% of professional players reported an injury within the previous year of playing.<sup>2</sup> Therefore, most players would receive benefit from an improved prehabilitation training program. Although injuries can result from poor technique and it is likely that such injuries are less frequent among more advanced players with appropriate technical skills, it has been reported that more advanced players are actually at greater risk of more serious and lower limb injuries.<sup>3</sup> It was suggested that this finding could be related to the higher velocity of play and the more rapid changes in direction characterized by more advanced players. This notion was supported by Kibler et al.<sup>4</sup> who attributed injuries in more advanced players to repetitive, excessive forces rather than poor technique. Therefore, it is essential to improve the quality rather than the quantity of training. This not only prepares players specifically to the demands imposed by competition but also reduces the overall training load by avoiding unnecessary stress that may contribute to injury.

Given the time and effort spent training fitness "off court", players should ensure their program is specific to the demands and characteristics of a tennis match. On court hitting and match practice drills must also employ the science of training to ensure the technical and mental aspects of tennis are optimized. Specific training has the benefit of enhancing the areas essential to the sport, which will increase the quality of training.<sup>1</sup> In order to achieve specificity in a training program, the demands and characteristics of actual competitive tennis must be identified.<sup>1</sup> Using this information, training strategies can be developed.

The current paper aims to use objective information about the characteristics of professional singles tennis, and discuss how the findings can be implemented into a tennis-specific training program.

## Specificity of Training

Tennis players should plan their training to address the requirements of competitive matches. The principle of specificity states that there is a direct relationship between the outcomes of training and the activity being completed as a training stimulus in terms of the effects on muscles and energy systems.<sup>5,7</sup> Thus, training has greater effect when it is similar to the requirements of the sport. However, match practice or competition alone is not sufficient to elicit an adequate training effect. Therefore, aspects of the sport should be considered and incorporated into training, which can be performed with higher quality and quantity to progressively overload and improve the player.<sup>1</sup> Since the effects of training on the body are very specific and not easily transferred from one activity to another,<sup>7</sup> the exercises used in training should reflect the demands and characteristics of tennis.<sup>8</sup>

A coach can continually evaluate the degree of specificity of a training program through awareness of various signs and symptoms. If there is insufficient specificity within training, the player may experience the following symptoms during or after competition: post-exercise muscle soreness, fatigue of specific muscles during activity, rapid onset of fatigue, and higher rating of perceived exertion.<sup>6</sup> If any of these symptoms are present, the coach should take corrective action to increase the sport and individual specificity of the training program. Chandler<sup>10</sup> has recommended the coach or trainer examine their training program in response to the question: "Is a fitness or performance component important in the performance of a tennis match?"

Specificity within the training program should address the: muscles involved, movements performed, speed at which

movements occur and the resistance to these movements, and the energy systems involved.<sup>6,9,10</sup> Specificity is also imperative when performing hitting drills and practice matches to avoid interference in technique since specificity is an important factor for motor control and learning.<sup>11</sup> Processing specificity explains the improvement in performance of a criterion task as being the result of similar underlying processes in the acquisition/practice task." Therefore, the motor patterns developed and practiced during tennis training should be similar to the requirements of competitive tennis. When completing drills and matches, emphasis should be retained on technique and stroke performance, particularly when fatigue or pressure is present.

Aside from the direct improvement of muscle, energy system and movement functions in response to specific training, specificity has the added advantage of increasing the efficiency of training. If training is specific to the demands of the sport, all unnecessary aspects of training are ignored, with attention being focused only on areas that can improve competitive performance. This increase in the quality of training may enable a reduction in the quantity of training." Excess training load may result in the negative repercussions of overtraining, which may include: persistent fatigue and muscle soreness, injury and illness, decline in motivation, and an overall reduction in performance.

**Activity Profile of Competitive Tennis**  
In order to implement maximum specificity into the training program, a comprehensive understanding of the activity profile of the sport is essential. A number of studies have investigated the activity profile of competitive tennis.<sup>12-19</sup> The information gathered in these analyses may be utilized to create a training program based on the specific demands of competition tennis.

The manipulation of the selected match variables provides a novel method of programming the training load. Reported match durations may be used to establish the length of training sessions and the mean number of games played within a match used to govern the number of "sets" completed within a training session. Average game durations from published studies may be used to determine the length of each training "set", whilst the mean number of points per game and average point durations may be used to determine the number and duration of "repetitions" within each "set".

**Match duration** indicates the total period in which a player must be able to sustain physical activity, although this duration is interspersed with recovery periods. The length of training sessions should reflect the average duration of a match, which would help to develop a player's muscular endurance and aerobic capacity to maintain optimal performance throughout a match. Most of the published studies have controlled the duration of matches or used

segments of matches for analysis. Kovacs<sup>15</sup> study of the US men's singles final in 2003 and 1988 revealed match durations of 294 and 101 minutes, respectively. The study by Morante and Brotherhood<sup>11</sup> included a total of 39 matches at the Australian Open and Wimbledon, comprising both men and women. An obvious difference between the genders exists due to the varying number of sets played in Grand Slam tournaments, with the average match duration for men being  $146 \pm 58.2$  minutes whilst women's matches were shorter at an average of  $89 \pm 24.6$  minutes. Court surface also showed a slight influence on match length with the average duration on the rebound ace being  $134 \pm 40.2$  minutes compared with the  $101 \pm 42.5$  minutes found on the grass of Wimbledon. The length of training sessions could, therefore, be manipulated around these averages, however it must be noted that matches may exceed well beyond these averages. If a training program lacked specificity to the duration of tennis matches, a player may experience symptoms mentioned earlier including fatigue and soreness, possibly resulting in a decay in performance towards the end of the match. The objective of a training program should be to attain match-specific fitness to prevent or delay the onset of fatigue and soreness, thereby helping to maintain performance.

**Point duration** represents the periods of peak physical activity within tennis matches. Point duration provides some information on the intensity of play, since it has been linked to energy expenditure or oxygen consumption ( $VC^{\wedge}$ ).<sup>19</sup> The overall average point duration of various published studies was calculated as  $6.9 \pm 3.1$  seconds. WW<sup>9</sup> g, differentiating the results from these studies according to gender, it was found that the mean point duration for men was 7.3 seconds whilst the average for women was 6.3 seconds. Furthermore, players can adopt different training strategies depending upon court surface. The analyses conducted on hard-court and clay showed similar mean point durations of 7.4 and 7.2 seconds, respectively, whilst matches played on grass revealed an average point duration of 4.9 seconds. These objective activity profiles of competitive singles tennis may be incorporated into training by determining the duration for each repetition of hitting, speed, agility or strength training tasks. The rest period allowed between each repetition within a set should be approximately 20 seconds, which is the maximum time permitted between points.<sup>20</sup> A match specific training program that involves repetitions within the ranges of point durations involved in competition may enable a player to maintain performance throughout play by resisting the fatigue and soreness that may develop if unaccustomed to the required duration of points.

**Game duration** may be considered when determining the number and duration of activity repetitions before a longer rest is allowed. Each "set" of activities may be arranged to reflect the average duration of

a game with recovery periods between each "set" not to exceed the 120 seconds allowed between games in a competitive match.<sup>20</sup> Morante and Brotherhood<sup>11</sup> found games duration to be an average  $169 \pm 24$  seconds for males and  $187 \pm 30$  seconds for females, whilst no difference existed between matches on hard and grass court surfaces. The number of points per game was determined through further analysis of the observations made by Morante and Brotherhood,<sup>11</sup> which found an average of  $6.1 \pm 0.5$  points/game for males and  $6.4 \pm 0.4$  points/game for females. The manipulation of these variables provides a novel method of programming the training load. Game duration may be used to determine the length of each training "set", whilst points per game and point duration may be used to determine the number and duration of each "repetition" within each "set". The number of games per match can also be integrated into training sessions by performing a similar number of sets of activities as number of games in a match. Additional calculations from this study<sup>1</sup> showed an average of  $37.7 \pm 13.5$  games per match for males and  $24.2 \pm 8.1$  games per match for females.

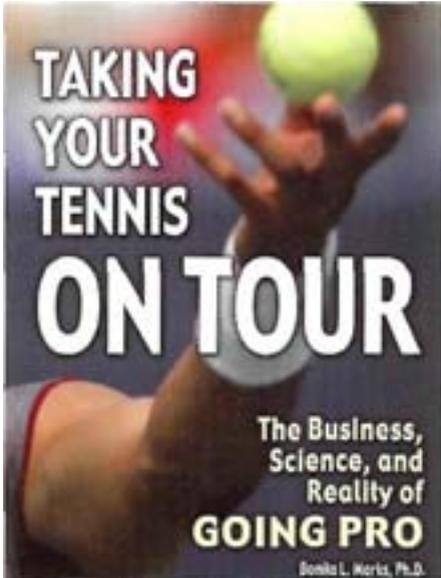
An example of the application for these factors could include selecting six different activities to be completed within a training session (E.g. 1: baseline hitting drill; 2: net approach hitting drill; 3: net play drill; 4: sprint speed drill; 5: agility drill; and 6: plyometric drill). Each of these six different activities can be performed five times to give a total of 30 sets within the session to reflect the number of games within a match. Each set should last approximately 175 seconds (3 minutes) to reproduce the average duration of games within a match. Within each of these sets, around  $6 \times 7$  second repetitions should be completed to re-create the demands of competition in terms of the average number of points within games and the average point duration. Recovery periods between each set should also mimic competition by not exceeding 120 seconds whilst no more than 20 seconds should be permitted between repetitions.

**Stroke frequency** is expressed in terms of the average number of strokes completed per minute. It would appear that stroke frequency should be considered in addition to point duration when considering the intensity of activity during tennis. Point duration provides information on the length of time players are physical active, however when taken alone it fails to express intensity. Whilst a match may have a long average point duration, the number of strokes completed within each point may be few if the ball is hit slowly or lobbed. The result is likely to be a lower energy expenditure since each player hits fewer strokes and would have more time to move to each ball. In contrast, a shorter point may consist of a greater number of strokes, meaning players hit more strokes

*To be continued on next page*

# Taking your Tennis on Tour

*The business, science and reality of going pro*



Taking your Tennis on Tour is a unique book, and very different from most of the tennis books on the market. This book gives great guidance to all aspiring young tennis players (and their coaches) in a very down to earth and practical way. It will be

in that rally and must move faster to position themselves for each stroke. Therefore, a relationship between point duration and stroke frequency exists that may be a major indicator of intensity. Average stroke frequency for professional male players was found to be  $44.5 \pm 1.2$  strokes per minute, whilst females performed  $42.9 \pm 2.3$  strokes per minute.<sup>1h</sup> furthermore, court surface showed an effect with grass producing a faster stroke frequency ( $44.6 \pm 1.2$  strokes/min) compared with rebound ace ( $43.1 \pm 1.9$  strokes/min)<sup>16</sup> and clay ( $42.6 \pm 9.6$ ).<sup>19</sup> A lack of match-specificity in training could result in a player being unable to maintain the required stroke frequency for the expected duration of points, therefore training should use match data to devise an appropriate training program.

To ensure maximum specificity and benefits from training, the demands of tennis should be determined with the subsequent training program being designed around the activity profile of the sport. However, it must be noted that if an individual player exhibits weakness in a particular technical, physical or psychological parameter, training may temporarily deviate from these recommendations until an appropriate standard is achieved.

## Conclusion

The science of coaching is becoming of increasing importance in a player's search for the competitive edge. A training pro-

gram should be planned in consideration of the characteristics and demands of tennis match play, ensuring the greatest possible specificity. Objective activity analysis provides the framework for the development of a specific training program designed to maximize competitive performance and reduce injuries.

a great help for all players who want to make the transition from college (or junior) tennis to professional tennis - and it will probably also make a few players think twice before taking that big step!

The first chapter on The College Route To The Pros is a good start on explaining the harsh differences between college tennis and professional tennis. Then in The Science of Going Pro, the most important physical, mental, and nutritional aspects of pro life are discussed. Part 3, The Business of Going Pro, offers insight into the economic realities of starting out, from private sponsorship plans and contracts to budgeting and even taxes.

In Part 4, The Reality of Going Pro, it is clearly shown that it is not all glamour and glitter on the tour, but may sometimes seem more like the gutter...

The real-life examples in the section "In their Own Words: the Best and Worst Aspects of Circuit life", are fabulous, and make you realise once again that only very few people out there make it into the top 100 - but that it can still be very worthwhile to try.

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This book is a must have for all those players starting out on the professional tennis tour - and for those trying to help them!

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