

Match Characteristics of Professional Singles Tennis

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Introduction

Tennis is played throughout the world by people of all ages and standards on a recreational or competitive basis. Despite the global popularity of tennis, the physical demands and player performance in competition are not fully understood. A tool is required to analyse competitive tennis for the objective evaluation of matters such as associations between performance and player characteristics, training and nutritional interventions, and environmental conditions.

Previous reports of time-motion and performance analysis in tennis inadequately describe the true nature of competition because they have either involved drills designed to represent points,^{1,2} simulated matches with time restrictions,^{3,4} or only considered segments of competitive matches for analysis.⁵

The aim of the present study was to assess activity patterns and performance during real competition singles tennis. Procedures similar to those described by Smekal et al.⁴ and Christmass et al.⁶ were used to analyse entire singles matches for males and females during the 2005 Australian Open and Wimbledon Championships. Effective playing time, duration of points, games and matches, and the stroke frequency were measured to provide information on the stresses of match play.

Methods

This study was a quantitative analysis of professional Grand Slam tennis.

Subjects

Forty-four players (male = 26; female = 18) competing in the main singles draw of the Australian Open, Melbourne in January, 2005 and Wimbledon Championships in London in June-July, 2005 were studied. The subjects were not aware they were being observed. The project was approved by the University of Sydney Human Research Ethics Committee.

ABOUT THE AUTHORS

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Study protocol

Singles matches from each of the rounds, the quarter finals, semi-finals and finals were randomly selected for analysis. Matches covered all time slots of the competition schedule (day and night). All matches analysed were played on centre court and were observed through being a live spectator or from television broadcast.

A stopwatch was used to measure the total duration of the match from the first serve until the final point of the match. Another stopwatch was used to measure the duration of each game, being started at the first serve of the game and stopped after the final point of the game. The duration of each point was measured with a third stopwatch, where timing started at the service ball toss and stopped when the point was complete. First serve faults and double faults were not counted for point duration.

The number of strokes was counted for each point, including the service and unforced errors.

Analysis

Additional factors were calculated from the primary observations made during matches. The effective playing time was determined from the sum of all point durations and expressed as a percentage of the total match duration. Stroke frequency was calculated for each point from the number of strokes and the duration of the

Abstract

The purpose of this study was to investigate the characteristics of professional male and female tennis competition during singles matches at the 2005 Australian Open and Wimbledon Championships to determine activity patterns and player skill. Thirty nine matches were analysed, involving 44 different players to give 78 sets of data.

Observations were made of: point duration, game duration, match duration and the number of strokes in each point. From these observations, the proportion of match time spent in play (effective playing time) and the stroke frequency were determined. Each of these factors was compared in males (n=28) and females (n=18) and between matches at the Australian Open (n=21) and Wimbledon (n=18). Point duration (s) was discovered to be higher in both males and females at the Australian Open compared with Wimbledon (Male: 6.4 ± 1.4 vs. 5.2 ± 0.8; Female: 7.0 ± 1.3 vs. 5.6 ± 0.6) (P<0.01). Effective playing time (%) was found to be greater at Wimbledon for both genders (Male: 20.5 ± 2.1 vs. 17.5 ± 2.4; Female: 21.1 ± 1.6 vs. 20.2 ± 2.1) (P<0.03). Stroke frequency (strokes/min) showed difference between the tournaments (P<0.01) and genders (P<0.02).

Mean stroke frequency for males and females, respectively were (Australian Open: 44.0 ± 0.6 vs. 42.2 ± 3.1; Wimbledon: 45.1 ± 1.3 vs. 44.1 ± 1.0). The methods used in the study provide a tool for assessing activity patterns, intensity and performance in tennis competition. The results provide original information about the stresses and characteristics of competitive professional tennis.

Table 1 Data (mean ± SD) comparing males and females from 39 matches (78 sets of observations) at the 2005 Australian Open and Wimbledon Championships, n = number of observations. * Male = best of 5 sets, female - best of 3 sets.

Variable	Australian Open		Wimbledon		Tournament (P)	Gender (P)	Interaction (P)
	Male(n=12)	Female (n=9)	Male(n=12)	Female (n=6)			
Match duration (min)*	154.2 ±47.2	113.5 ±33.2	137.0 ±69.1	65.3 ±15.9	0.08	0.004	0.398
Game duration (s)	178.6 ± 26.2	183.8 ±29.4	159.0 ±22.3	189.8 ±31.0	0.479	0.067	0.189
Point duration (s)	6.4 ± 1.4	7.0 ±1.3	5.2 ±0.8	5.6 ± 0.6	0.01	0.186	0.849
Effective playing time (%)	17.5 ± 2.4	20.2 ±2.1	20.5 ±2.1	21.1 ±1.6	0.027	0.064	0.235
Stroke frequency (strokes/min)	44.0 ± 0.6	42.2 ±3.1	45.1 ±1.3	44.1 ±1.0	0.01	0.013	0.483

point. The intra-tester and inter-tester reliability / reproducibility was determined by the main tester and a second individual, both analysing the same randomly selected set for the point duration (range: 0 - 21.2s) and game duration (range: 74 - 558s). Effects of gender and tournament on the selected variables were examined by analysis of variance. Statistical analyses were performed using SPSS version 13.0.

Results

Analysis of 39 separate matches provided 78 sets of data. The mean values for the observations made during matches and derived data are presented in Table 1. The large range in match duration is mainly due to men's singles in Grand Slam tournaments being best of five sets, whilst women's matches are only best of three sets.

There was excellent agreement between and within observers. The intra-class correlation for four sets of observations (two per observer) was 1.00 and 0.998 for game and point duration, respectively.

Discussion

Statistical analysis demonstrates a high level of reliability for these methods as a tool for examining tennis activity patterns and the effects of interventions. The results obtained through this study also show agreement with those of previously published tennis analyses, illustrated in Table 2.

Observations may vary between studies as a result of differences in study design. Some investigations used tennis-specific drills,^{1,2} others used time-restricted matches^{5,4} or segments of matches³ whilst the present study used complete matches in tournament conditions. The criteria for measurements may also have varied between studies. For example, investigators did not report whether point duration began with the first service or the serve that commenced the point; whether stroke counts included errors; and whether breaks in play due to scoring disputes and injury time-outs were included as playing or non-playing time.

Furthermore, O'Donoghue and Ingram⁵ have reported that playing style, player

gender and court surface influence activity and performance analysis. These variations between studies indicate the need for standardisation of procedures to facilitate comparison between investigations.

The observations included in the present study were selected to provide an account of the activity patterns and intensity during competitive tennis. Observations made during competition rather than training, drills or simulated matches is the most objective tool for assessing the impact of factors that determine tennis performance.

Although match duration on average was longer in males than females because of the difference in set numbers, it is possible for a close female match involving three sets, many games and points to be as long or longer than a decisive three set male match. Effective playing time indicates the proportion of time spent in peak physical and mental activity but occupies less than one quarter of match duration. The time not spent in play involves the time between points and games where players are less physically and mentally active, walking to change ends and tactically planning for the next point.

Despite the limitations on time between points (20s), games (90s) and sets (120s), it is possible for players to alter the non-playing time by choosing to use this time or to initiate play earlier for tactical reasons. Point duration indicates the peak activity during tennis and has been linked to oxygen consumption (VO₂).⁴ Point duration was found to be shorter at Wimbledon for both genders, relating to factors such as the less consistent ball bounce on grass, the style of game employed on grass (net play) and the increased speed of the court surface. Stroke frequency indicates playing intensity and the skill level of the players.

The significantly higher stroke frequency in males compared to females is likely to reflect the style of play (males tend to serve-volley more than females) and the greater physical power of males, resulting in faster ball velocity and court running speed. Stroke frequency is also higher at Wimbledon, where the grass increases the ball speed from the surface, in addition to

a greater tendency to volley. Effective playing time was higher among females, which may be associated with the higher point duration and game duration when compared with males.

Despite the relatively small number of data points in the present study, statistical differences have been established. This suggests that the procedures used in the study provide objective assessment of activity in tennis competition. They could therefore be used as a tool by scientists, coaches, fitness trainers or medical staff to evaluate associations between player characteristics and performance, training and nutritional interventions, and environmental factors.

Conclusion

The results of this investigation provide original information about the stresses and characteristics of competitive professional tennis. The methods used in the study provide a tool for assessing activity patterns, intensity and performance in tennis competition.

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Table 2 Published tennis analyses

Study	Match Duration (min)	Point Duration (s)	Effective Playing Time (%)	Work to Rest Ratio	Stroke Frequency (strokes/min)
Present study	M=145.6±58.5 F= 97.9±37.3	M=5.9±1.3 F= 6.4 ±1.2	M=19.0±3.0 F=19.9±2.3	M = 1:4.4±0.8 F = 1 :4.1 ±0.6	M = 44.5±1.2 F = 42.9±2.3
Smekal et al. ^{1,4}		M= 6.4 ±4.1	M=16.3±6.6	M = 1 : 3.4	M = 42.6±9.6
Elliott et al. ³	M=60	M=10.0±1.6	M=26.5±3.5	M = 1 :2.9	
Christmass et al. ⁶	M=90	M=10.2±0.3	M=23.3±1.4	M = 1 :1.8	
Reilly & Palmer ⁷		M=5.3±1.05	M=27.9±3.9	M = 1 :3.1	
Chandler ⁸	M=294 F=101	M=12.2 F=10.8		M = 1 :3.4 F = 1 :2.7	
O'Donoghue and Ingram ⁵		M+F = 6.3±1.8			