ORIGINAL ARTICLE

Comparison of game characteristics of male and female tennis players at grand-slam tournaments in 2016

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Abstract
The aim of our study is to compare selected game characteristics on different surfaces among all grand-slam tournaments and between male and female professional tennis players. We analyzed match characteristics from all grand-slam tournaments – Australian Open, French Open, Wimbledon and US Open. We had data from all the matches and tournaments (127 singles matches from male and 127 female singles matches per each tournament). We compared the tournaments and also the genders. The data of the match characteristics were obtained through the official tournaments websites. The results showed women won significantly more return games compared to men (by 12%); men won significantly more points after 1st and 2nd serve compared to women (by 7% or 6% respectively); men played significantly more games per set; and women played significantly more points per game. Faster surface provides greater advantage to the server. Therefore it is important to practice serves prior these tournament. The least percentage of winners was reached at US Open. The mean percentage of 2nd serve points won in women's matches reached only 45%, therefore receiving the 2nd serve could be an advantage in women's tennis. The receiver should use this advantage by a good return.

KEYWORDS: tennis match, match statistics, serve, return stroke, serve efficiency.

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Introduction

There are various possibilities of data outcomes from tennis match, such as percentage of first serve in, return games won, unforced errors etc. These data can help players and coaches understand and consider strategies and game plans and also can show differences among various court surfaces or genders and their playing styles. Match records, such as umpires' scorecards, may provide valuable information for scientist, coaches and players [11].

There are some biological and rules differences between the genders. As in format of play, in grand-slam tournaments (Australian Open, French Open, Wimbledon and US Open), men's singles matches are played best of five sets and women's only best of three sets. In US Open, a final set is played as a tie-break set; in the rest of the grand-slam tournament is the final set played as an advantage set (difference of two games). There are psychological, anatomical and biomechanical differences between male and female players, which can result in the maximum speed serve (women's service doesn't reach such velocities as the men's service) [7].

Tennis serve is the most frequent stroke in tennis singles, representing 45% (French Open) to 60% (Wimbledon) of the total number of strokes in a match [18, 21]. The serve is one of the key elements of the game performance. However, the receiver also tries to be as successful as possible. The serve return is therefore also one of the most important game activities of an individual. Even on the slowest surface (clay courts), serving and returning remain strokes that largely influence the result of a match [14] as 53-64% rallies are finished within the

first 4 shots [4, 22]. Ball flight duration from the server to receiver is between 0.5-1.2 s depending on the quality of service, its initial velocity and the court surface [9, 20]. Therefore, anticipation and quick reactions are very important in tennis and also in other sports [2, 3, 6].

A faster surface provides much less time to respond, and serving on faster surfaces becomes an even greater advantage both in male and female tennis [5]. This is supported by Fernandez et al. [10], who reported rallies are finished with fewer shots on grass due to faster surface comparing to clay courts. The court pace is being measured [15, 16]. International tennis federation measures "Court pace rating", i.e. the effect of ball-surface interaction and categorizes the surfaces to slow, medium-slow, medium, medium-fast and fast [16]. Players use different strategies on these surfaces, i.e. more attacking strategy is used on faster surfaces or the women's singles rallies took significantly longer, as men have different style of play, e.g. tend to serve-volley strategy more often [10].

The purpose of the study is to show differences among the grand-slam surfaces and gender on these tournaments. This was partly investigated in some previous studies [5, 8, 12, 19]. They analyzed serves speeds, aces, games per set and points per game across the grand-slams in previous years [8]; or investigated total points won, number of unforced errors, percentage of receiving points won, percentage of the first serve, winning percentage of the first and second serve and other related data [12]; or analyzed similar data at French Open and Wimbledon and compared the results of match winners and losers [19]; and differences were shown between the genders and among grass, clay and hard surfaces in total number of points and service points won in tennis doubles [5]. The aim of our study is to compare selected game characteristics on different surfaces among all grand-slam tournaments and between male and female professional tennis players.

Material and Methods

Participants
We analyzed all singles matches from grand-slam tournaments in 2016. All together 1016 matches were played (127 men's and 127 women's matches in each tournament). Several matches were not finished due to retirement of player or walkover (match not played): Australian Open − there was a retirement in 6 men's matches and 4 women's matches; French Open − 1 walkover and retirement in 4 men's matches and retirement in 2 women's matches; Wimbledon − 1 walkover and retirement in 2 men's matches and retirement in 3 women's matches; US Open − 1 walkover and retirement in 9 men's matches and retirement in 2 women's matches. Australian Open was played on hard surface (Plexicushion); French Open on red clay; Wimbledon on grass surface; and US Open on hard surface (DecoTurf). This study was approved by the Ethics Committee at the Faculty of XXX, at XXX.

Apparatus and procedures
Data was obtained through official statistical records of each tournament. These were available online on the official tournament website [1, 13, 23, 24]. We compared following tennis game indicators between male and female players; and among each grand-slam tournament. They were chosen on the basis of previous studies [5, 12, 19]. We observed: total number of sets played, games played, total number of points played, 1st serves in (percentage of successful first serves from the total number of first serves), 1st serve points won % (percentage of points won after successful first serve from total number of points with successful first serve), 2nd serve points won % (percentage of points won by second serve from total number of points played by second serve), games per set, points per game, return games won % (percentage of games won by the receiver of total number of games), percentage of points finished with a winner (percentage of points finished by a winner from the total number of points) and percentage of points finished with unforced error (percentage of points finished with an unforced error from the total number of points).

Data analyses
Data evaluation was carried out using descriptive characteristics such as mean, standard deviation, absolute and relative values. For the tournament comparison men and women data were collected separately. For genders comparison we used absolute values, mean values and standard deviation from all four tournaments. Independent samples T-test were conducted to reveal the statistical significance between the groups. The significance level was $\alpha = 0.05$.

Results
Table 1 shows the game characteristics of men's matches in all grand-slam tournaments. Men played more sets, games and points in all tournaments, but this is expectable due to format of play (best of five sets). Women's game characteristics are shown in Table 2.
Men's and women's matches were compared (Table 3) T-tests showed that the 1st serve points won % was

Table 1. Summary of men's matches on each grand-slam tournament

	Australian Open	French Open	Wimbledon	US Open
Sets played	462	453	466	460
Games played	4577	4367	4722	4408
Total points	28723	27943	28975	28005
1st serves in %	62.40	61.90	63.40	56.90
1st serve points won %	72.70	67.90	75.70	71.70
2nd serve points won %	50.60	51.30	52.90	48.90
Games per set	9.91	9.64	10.13	9.58
Points per game	6.28	6.40	6.14	6.35
Return games won %	18.75	23.66	17.11	24.23
Points finished with a winner %	31.45	33.53	34.57	23.07
Points finished with unforced error %	30.35	30.76	24.85	24.08

Table 2. Summary of women's matches on each grand-slam tournament

	Australian Open	French Open	Wimbledon	US Open
Sets played	287	298	290	292
Games played	2667	2733	2799	2680
Total points	17487	18133	18008	17520
1st serves in %	60.90	62.10	65.60	60.70
1st serve points won %	65.00	63.40	66.60	65.60
2nd serve points won %	44.90	45.40	46.60	44.60
Games per set	9.29	9.17	9.65	9.18
Points per game	6.56	6.63	6.43	6.54
Return games won %	32.73	36.48	30.15	35.37
Points finished with a winner %	28.62	32.49	30.05	22.25
Points finished with unforced error %	37.00	34.08	30.72	28.84

Table 3. Comparison of men's and women's matches on all grand-slam tournaments

	Men		Women		
	M	SD	M	SD	difference
Sets played	1841	–	1167	–	674
Games played	18074	–	10879	–	7195
Total points	113646	–	71148	–	42498
1st serves in %	61.15	2.90	62.33	2.27	−1.18
1st serve points won %	72.00**	3.22	65.15	1.34	6.85
2nd serve points won %	50.93***	1.66	45.38	0.88	5.55
Games per set	9.82*	0.25	9.32	0.23	0.49
Points per game	6.29*	0.12	6.54	0.08	−0.25
Return games won %	20.94***	3.54	33.68	2.83	−12.75
Points finished with a winner %	30.66	5.22	28.35	4.37	2.30
Points finished with unforced error %	27.51	3.53	32.66	3.62	−5.15

Significantly different than women ($p < 0.05$)*; ($p < 0.01$)**; ($p \leq 0.001$)***

significantly higher in men's matches compared to women's matches $t(6) = 3.93$, $p = 0.008$; 2nd serve points won % was significantly higher in men's matches compared to women's matches $t(6) = 5.91$, $p = 0.001$; men played significantly more games per set compared to women $t(6) = 2.90$, $p = 0.027$; women played significantly more points per game compared to men $t(6) = −3.53$, $p = 0.012$; and women won significantly more return games compared to men $t(6) = −5.52$, $p = 0.001$.

Discussion

The aim of this study was to compare selected game characteristics on different surfaces among all

grand-slam tournaments and between male and female professional tennis players.

Most games per set were played in Wimbledon in both genders. These data agree with Cross and Pollard [8], who argue that this is due to the fast surface. Women play significantly fewer games per set. This may indicate that the women sets are less equal compared to men. If this would be the criteria of the courts surface pace, Wimbledon would be the fastest followed by Australian Open and next US Open and French Open, which would be almost on the same level. However the surface pace is measured by a special device [15, 16].

In the points per games category, Wimbledon reached the least number of points per games similar to Cross and Pollard [8]. Women play significantly more points per games in all grand-slams; therefore the games are more equal than in men's matches. This may be interpreted by the serve speed and serve efficiency, which may give greater advantage to men.

The mean of 1st serve points won percentage in men's matches is almost identical with Katic et al. [19]. This shows no change from their study in 2009. Women reached 7% less 1st serve points won and 6% less 2nd serve points won. This may be because of the serve speed and serve efficiency of the genders. Similar results were showed in doubles [5]. They say that faster surface provides greater advantage to server and women won 8-10% less service points compared to men.

Both men and women had the highest 1st serve in at Wimbledon. This might be explained, they can allow controlling the serve more with a spin. And despite of this the grass surface provides sufficient compensation. Also the percentage of points won after the second serves is the highest at Wimbledon, very similar to [19]. And together with the least return games won in Wimbledon, this can show that returning is the most difficult on grass surface and the grass surface provides the biggest advantage to the server [5]. Women won 13% more games compared to men and this difference was significant. This can be due to lower serve speed of women, which could make the returning easier.

In men's matches, there were some similar characteristics for the court surfaces. The players reached most 1st serve points won on Australian Open and Wimbledon, which could affect the percentage of return games won, as this was the lowest on these tournaments. This percentage of return games won was about 6% lower compared to French and US Open. Surprisingly, the most return games won percentage was at US Open from the men's matches. And also the least percentage of winners was at US Open (by 8-12% lower compared to the rest of the tournaments). This may be explained that purely offensive style at US Open is not that efficient and effective as at Australian Open (also hard surface) or Wimbledon. The highest percentage of winners from the total points was very similar in Australian, French Open and Wimbledon. However as already mentioned, at US Open this number was 8-12% lower in men's matches and 6-10% lower in women's matches. Notably, most percentage of winners in women matches happened in French Open, on the slowest grand-slam surface.

Players win about 35% of points, when they are receiving [12, 19]. This is similar to women receivers in our study, as they won 33% of games as receivers. However, men managed to win only 20% of games as receivers. This may be due to serve speed and efficiency of the genders.

The least percentage of unforced errors and winners was at US Open both in men's and women's matches. This may show that players try to play more safely and are not that offensive as in Australian Open or Wimbledon. In general, the result showed the men reached more winners and less unforced errors compared to women, however there was no statistical difference between the genders. Similar findings were showed by Filipcic et al. [12].

All the variables can be influenced not only by the court surface, but may be influenced by different brand or type of balls and weather conditions as well (e.g. hot weather can provide faster ball speed due to lower air density). There are various balls types, which are intended for various court surfaces, e.g. Ball type 1 (fast speed ball) is intended to play on slow surfaces [10, 17]. Other variable could be the ball endurance, i.e. how long, or how many games (or points) can a new ball retain its initial characteristics. Because after several games (or points) it can start to lose e.g. the ball pressure or can have different wear after high speed contacts with the ground. This can affect the ball flight characteristic (e.g. it may be harder to hit a winner after several games).

Conclusions

Every grand-slam tournament has some different and some very similar characteristic for the match outcomes. The sets in Wimbledon are the most equal. Faster surface should provide greater advantage to the server. Therefore it is important to practice serves prior these tournament. Observed variables such as 1st serve points won or return games won are similar for Wimbledon and Australian Open; and US Open is similar in these variables to French Open. The least percentage of winners was reached at US Open, therefore defensive

style can be useful here. The difference between the genders is the efficiency (1st and 2nd serve points won), which in fact is connected to the number of return games won between the genders. As the men serve faster [8], it is harder for them to win a return game. Women won more return games compared to men. The receivers in women's matches won more points on the 2nd serve compared to server. Therefore, 2nd serve is advantage for the receiver in women tennis. In this case, the receiver should use this advantage by a good return and win the point.

References
1. Australian Open. Event Stats. 2016; Retrieved October 19, 2017, from http://www.ausopen.com/en_AU/scores/extrastats/index.html.
2. Balkó S, Borysiuk Z, Balkó I, Spulak, D. The influence of different performance level of fencers on muscular coordination and reaction time during the fencing lunge. Arch Budo. 2016; 12: 49-59.
3. Balkó S, Borysiuk Z, Šimonek, J. The influence of different performance level of fencers on simple and choice reaction time. Rev Bras de Cineantropometria Desempenho Humano. 2016; 18(4): 391-400.
4. Blau M. Tempo of tennis play at French Open 2017 (Unpublished master's thesis). 2017. Charles University, Praha: UK FTVS, Czech Republic.
5. Carboch J, Kocib T. A comparison of service efficiency between players of male and female doubles at professional tennis tournaments. Acta U Carol Kinan; 2015; 51(2): 56-62.
6. Carboch J, Süss V. Toss differences between the slice serve and the kick serve in tennis. Acta Gymnica. 2015; 45(2), 93-97.
7. Crespo M, Miley D. Advanced coaches manual. 1998. London: ITF.
8. Cross R, Pollard G. Grand Slam men's singles tennis 1991-2009 serve speeds and other related data. ITF Coaching and Sport Science Review. 2009; 16(49): 8-10.
9. Dunlop JI. Characterizing the service bouncing using a speed gun. In: Haake SJ, Coe A, eds. Tennis Science Technology. Oxford: Blackwell Science, 2000; 183-190.
10. Fernandez J, Mendez-Villanueva A, Pluim BM. Intensity of tennis match play. Br J Sports Med. 2006; 40(5): 387--391.
11. Filipcic A, Caks KK, Filipcic T. A comparison of selected match characteristics of female tennis players. Kinesiologia Slovenica. 2011; 17(2): 14-24.
12. Filipcic T, Filipcic A, Berendijas T. Comparison of game characteristics of male and female tennis players at Roland Garros 2005. Acta Universitatis Palackianae Gymnica. 2008; 38(3): 21-28.
13. French Open. Event Statistics. 2016; Retrieved October 19, 2017, from http://www.rolandgarros.com/en_FR/scores/extrastats/index.html
14. Gillet E, Leroy D, Thouvarecq R, Stein JF. A notational analysis of elite tennis serve and serve-return strategies on slow surface. J Strength Cond Res. 2009; 23(2): 532--539.
15. Goodwill S, Haake S, Spur J, Capel-Davies J. Development of a new system for measuring tennis court pace (P126). Engineering Sport. 2008; 7(1): 649-657.
16. ITF. Court Pace (ITF CS 01/02). 2017; Retrieved September 18, 2017, from http://www.itftennis.com//technical/courts/court-testing/court-pace.aspx
17. ITF. Appendix I: The Ball. 2017; Retrieved September 19, 2017, from http://www.itftennis.com/technical/publications/rules/balls/appendix-i.aspx
18. Johnson CD, McHugh, MP, Wood T, Kibler WB. Performance demands of professional male tennis players. Br J Sports Med. 2006; 40(8): 696-699.
19. Katic R, Milat S, Zagorac N, Durovic N. Impact of game elements on tennis match outcome in Wimbledon and Rolland Garros 2009. Collegium Antropol. 2011; 35(2): 341-345.
20. Kleinöder H. The return of serve. ITF Coaching Sport Science Review, 2011; 2: 5-6.
21. O'Donoghue P, Ingram B. A notation analysis of elite tennis strategy. J Sports Sci. 2001; 19(2): 107-115.
22. Schönborn R. Strategie und Taktik im Tennis Theorien, Analysen und Problematik − begründet aus noch nie dargestelltem Blickwinkel. 2012; Gelnhausen: Wagner.
23. Wimbledon. Event Statistics. 2016; Retrieved October 19, 2017, from http://www.wimbledon.com/en_GB/scores/extrastats/index.html
24. US Open. Event Statistics. 2016; Retrieved October 19, 2017, from http://www.usopen.org/en_US/scores/extrastats//index.html?promo=subnav