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Original Article

Development of Rally Pace and Other Match Characteristics in Women's Matches in the Australian Open 2017

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Abstract:
Only the best players reach the last stages of the grand-slam tournaments. The aim is to analyze rally pace characteristics and frequency of rally shots in women's matches between the early (1st to 4th round) and late (quarterfinal – final round) tournament stage at the Australian Open 2017. We analyzed total 23 matches at the Australian Open 2017 and compared (1) point duration; (2) number of rally shots; (3) time between the points; (4) rally pace; and (5) work to rest ratio. The rally pace was significantly faster in the late tournament stage 1.16±0.02 s compared to the early stage 1.23±0.05 s (p<0.001). In the late tournament stage the point duration was shorter (p<0.01), the number of rally shots was lower (p=0.03) and work to rest ratio was higher (p<0.001) compared to the early stage. The point was finished within the first 4 shots in 69 % in the late tournament stage, which was 10 % more compared to the early stage. Coaches and players can use these findings to adopt useful strategy or playing style in their practice sessions and matches.
Key words: performance analyses, tennis, physiology, training

Introduction

A tennis player needs to react very quickly on an incoming ball because the opponent tries to hit the ball as fast as possible to hit a winner or to provide the opponent as least time as possible. E.g. a ball can fly from the server to receiver 0.5–1.2 s depending on the serve quality, serve type, its initial velocity and spin or the court surface (Dunlop, 2000; Kleinöder, 2001). Therefore not only quick reaction time, but quick visual-motor response is required as well (Balkó, et al. 2018, Erickson, 2007). High-speed rallies are finished within the first four shots in more than 50 % of points in professional tennis (Weber et al., 2010).

Tennis is characterized by intermittent load, i.e. high intensity intervals of cyclic and acyclic movements, and rest intervals (Crespo & Miley, 2002; Fernandez, Mendez-Villanueva & Pluim, 2006). Morante & Brotherhood (2005) measured mean point duration 7.0 s in women tennis at the Australian Open. After the point is finished a rest follows. The time between the points reaches 19.4 s in women's tennis Schönborn (1999). Tennis rules allowed 20 s between the points until 2017 (ITF, 2017); however this has been changed to 25 s since 2018 (ITF, 2018). The work to rest ratio in tennis is between 1:2 - 1:5 depending on the court surface (Christmasset al., 1998; Fernandez et al., 2006; Kovacs, 2004; O'Donoghue & Ingram, 2001; Reid & Duffield, 2014; Smekal et al., 2001). The players need to maintain their high performance not only during the whole match but during the whole tournament as well.

The best players play up to seven singles matches at grand-slam tournament; therefore they need to be very well prepared. A tennis match can last several hours (Reid & Duffield, 2014) however women's matches are shorter at grand-slams during a different scoring format (best of 5 or best 3 sets) (Morante & Brotherhood, (2005). The intensity of play depends on the opponent's style, tactics and strategy, actual weather conditions or court surface. A fatigue can affect the player's performance in long matches (Martin et al., 2016) not only in tennis, but also e.g. in baseball (Escamilla et al., 2007; Murray et al., 2001). However, fatigue can appear not only in long matches but after the match as well. Therefore the player needs to recover for the next match. At grand-slams tournaments players are usually scheduled to play the single matches every two days. However, they may play a match even the next day if there are some weather delays. Some players also participate in doubles or mixed doubles events. These players can play more matches in one day and can have less time for recovery. Therefore, the best single players often play only the singles event but sometimes they can join other events.

Tennis match causes an extreme speed and strength load of lower limbs and one day doesn't need to be enough for recovery (Ojala, & Häkkinen, 2013). This supports Reid & Duffield (2014) showing that players move less during the match and also in following days; or Gescheit, et al. (2015) reporting decrement in sprinting and jumping in consecutive days matches. Girard et al. (2006) reported that explosive power is decreased after the match only and during the match it is only the decrement of maximum voluntary contraction and increased leg stiffness (Ojala, & Häkkinen, 2013). The purpose of this study is to analyze the development

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of selected match characteristics during the tournament stages. The aim is to compare rally pace characteristics and frequency of rally shots in women's matches between the early (1st to 4th round) and late (quarterfinal – final round) tournament stage at the Australian Open 2017.

Material & methods

Participants

We analyzed altogether 2926 points in 23 women's matches at the Australian Open 2017. We divided these matches into two groups according to the stage of the tournament. The early tournament stage (ES) consisted of the 1st – 4th round matches. In this group the professional tennis players n = 24 (26.3±4.4 years) had a mean WTA ranking of 49.8±51.8. We observed 2 first round matches, 3 second round matches, 5 third round matches and 6 fourth round matches. In the late tournament stage (LS), i.e. quarterfinal (QF) – final (F) rounds, the players n = 8 (29.4±5.6 years) had the mean WTA ranking 22.6±25.5. We analyzed all the matches in this stage, i.e. 4 quarterfinals, 2 semifinals and final match. This study was approved by the Ethics committee.

Procedure

The match recordings were obtained from television or internet broadcast. The quality of the video was deemed appropriate for the analyses. A spreadsheet with all the observed variables was prepared in advance for each match. The variables were: (1) Point duration – the measurement of this variable started by striking the ball by the server (in case of 1st serve fault the measurement started by striking the ball by the 2nd serve) till the point was finished. The point was finished in following cases – when the ball was out (touched the court outside the lines or hit the permanent fixture); the ball finished in the net; when the ball bounced for the second time. (2) Number of rally shots – every stroke (racket-ball contact) was considered as a shot excluding the case, when the ball just touched the racket frame and continued behind the striking player (this was not considered as a shot). (3) Time between the points – the time was measured since the point was finished, until the racket-ball contact by the 1st serve. The time was measured only during the games (from the end of the first point of each game until the last point of the game). This variable was not measured during changeovers and after the end of the game or during tie-breaks (delays in ball delivery to opposite court end). The time between the points was not measured in following unusual situations, which would delay the reasonable pace: racket change, medical time out, discussion or argue with chair umpire, use of hawk-eye, unusual crowed behavior delaying the game. (4) Rally pace – point duration divided by rally shots. (5) Work to rest ratio (point duration/time between the points). Data were excluded from the sample, when a player made a double fault (time between the points was not excluded); when the ball became invisible (e.g. landed in the stands) or when the rally started during a commercial break.

Each match was observed twice. Point duration and rally shots were observed during the first observation. The time between the points was observed during the second observation. The evaluator had 1 hour practice session for data observation and measurement before he started the match analyses. The time was measured using the stopwatch. After every point, the video-recording was stopped and the evaluator marked the measured variables into the spreadsheet. In unclear situations, the video-recording was paused or reviewed.

Data analyses

All the matches were analyzed by one evaluator. The evaluator had a one-hour practice session for data observation and measurement before he/she started the match analyses. The intra-rater reliability (ICC) reached in all the observed variables ≥ 0.97. Firstly, we calculated the means of each variable from every single match in each group. Using SPSS 15.0, these data were analyzed using descriptive statistics and independent samples t-tests. Effect sizes (Cohen's *d*) were calculated and can be interpreted as small (0.20 to 0.49), moderate (0.50 to 0.79), and large ($d \geq 0.80$) (Cohen, 1988).

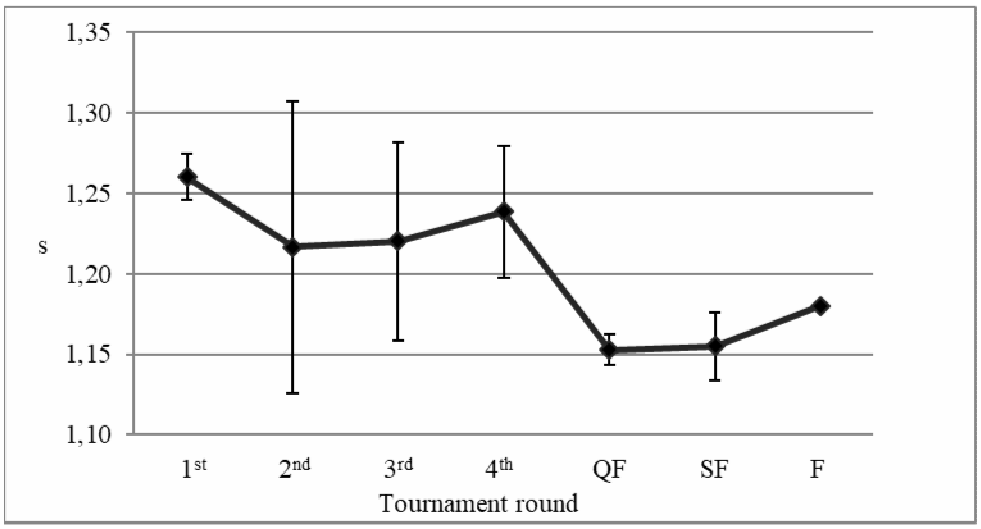
Results

Independent samples t-tests showed significant difference in number of rally shots, point duration, rally pace and work to rest ratio between ES and LS (table 1). Cohen *d* showed large effect in the same variables. This indicates that QF – F matches had less shots in the rally, the point duration is shorter, the rally pace is faster and work to rest ratio is higher. The rally pace development during particular tournament rounds shows figure 2.

Table 1. Match characteristics of early and late tournament stage (1st - 4th round and QF – F).

	1st – 4th	QF – F	Mean	95% Confidence Interval of the Difference				Cohen
	Mean ± SD	Mean ± SD	Difference	Upper	Lower	T-test	*p*	*d*
Rally shots	4,70±0,19	*4,03±0,41	0,68	0,08	1,27	2,34	0,03	2,10
Point duration	5,84±1,15	**4,67±0,48	1,17	0,28	2,06	3,42	<0,01	1,32
Time between points	21,27±1,91	21,20±2,22	0,07	-1,76	1,91	0,08	0,93	0,03
Rally pace	1,23±0,05	***1,16±0,02	0,07	0,04	0,11	4,97	<0,001	1,84
Work to rest ratio	1:3,79±0,74	*1:4,54±0,40	-0,75	-1,34	-0,16	-2,64	0,02	-1,26

Significantly different than 1st – 4th round ($p < 0.05$)*; ($p < 0.01$)**; ($p < 0.001$)***.



Legend: QF – quarterfinal; SF – semifinal; F – final.

Figure 1. Rally pace during the tournament.

The biggest difference in frequency of rally shots was in the first 3 shots of the rally between ES and LS (figure 2). The point was finished within the first four shots in 59 % (ES) and in 69 % (LS) cases; within 5-8 shots in 28 % (ES) and 24 % (LS) cases; and within 9 and more shots in 9 % (ES) and 6 % (LS) cases.

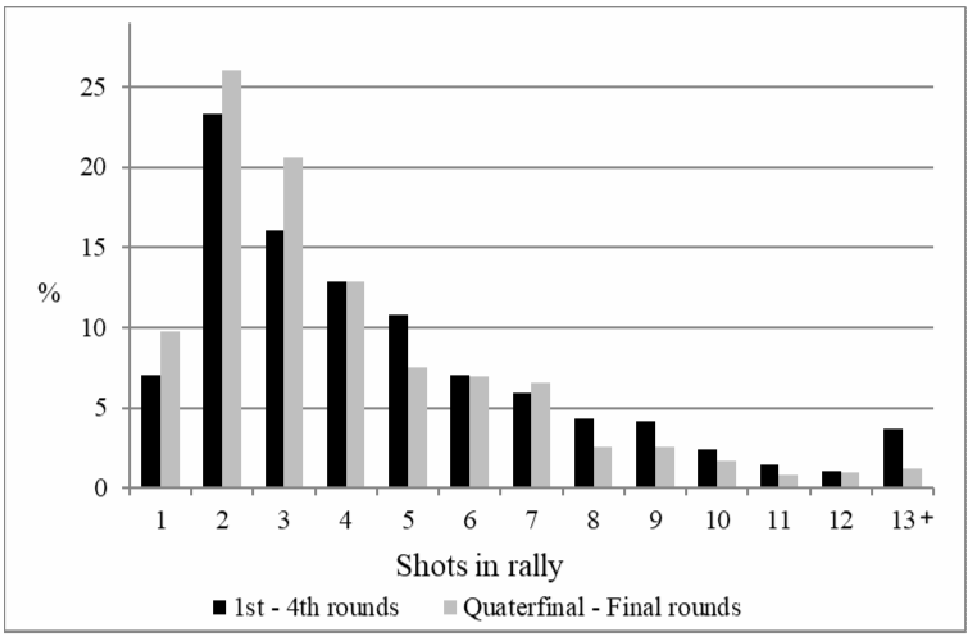


Figure 2. Frequency analyses of rally shots number in tournament stages.

Discussion

Our aim was to compare rally pace characteristics and frequency of rally shots in women's matches between the ES and LS at the Australian Open 2017. We found significant differences in most of the observed variables including the rally pace (duration of the ball delivery from the opponent, in other words the time the player has to hit the ball after the opponent's stroke).

The rally pace was significantly faster in LS. This can suggest that higher ranked players tried to play in faster rally pace compared to lower ranked players. Higher ranked players cover more distance (Galé-Ansodi et al., 2017). And furthermore it appeared to be an advantage to play in faster rally pace at the Australian Open. However on other surfaces this may not be true as different strategy may apply, e.g. on slow surfaces such as clay courts (Ponzano & Gollin, 2017). Men play in higher pace compared to women as men reach significantly higher running speed and cover more meters on the court (Galé-Ansodi et al., 2017; Reid et al., 2016). Women hit fewer shots in LS in the rally to the ES. The mean number of rally shots is closely connected with the point duration. Compared to the research at the Australian Open 2005 (Morante and Brotherhood, 2005), the point duration was 1.6 s shorter at the same tournament in 2018. This can suggest that women tennis is becoming

faster and more aggressive compared to the past. Our results suggest that more successful tennis players reaching the LS are playing even more aggressively (faster rally pace and shorter rallies).

The point was finished within the first four shots in 10 % more cases in the LS compared to the ES and notably reached 69%. This value is much higher compared to 54 % from French Open 2009 (Schönborn, 2012; Weber et al., 2010). The biggest difference in our study can be observed between the ES and LS in the first three shots of the point (figure 2). These results can be attributed to more aggressive playing style and strategy nowadays which may be the most effective on this surface. And more, this shows the importance of serve and 3rd rally shot combination for the server, and the importance of a good return shot for the receiver (Filipcic et al., 2015). The serve should prepare a good position for her 2nd shot to get the advantage and the receiver should try not to allow this. The players rested the same time between the points in both tournament stages, using maximum from allowed 20 s by the rules (ITF, 2017). However different point duration resulted in different work to rest ratio. New rule introduced in 2018 allowing 25 s between the points (ITF, 2018) may affect the work to rest ratio. This information can help coaches to utilize the practice sessions. Match duration of women matches was reported to be on average 40 minutes shorter at grand-slams due to different scoring format compared to men (Morante and Brotherhood, 2005) however fatigue can negatively influence player's performance (Martin et al., 2016).

Gescheit et al. (2015) argue fatigue does not affect the stroke speed in consecutive long matches but decreases the total movement in explosive tasks of lower limbs such as sprinting and jumping. This could partly explain our results why women reached fewer shots in LS. On the other hand they played in faster pace; which could suggest that players were not influenced by fatigue from previous rounds. As the fatigue from previous matches was proofed, fatigue reflects in decrement of court coverage, lower explosive power of lower limbs such as sprinting and jumping (Ojala & Häkkinen, 2013; Reid & Duffield, 2014). This can result in late stroke preparation. According to Ferrauti et al. (2001), if the player is lately positioned for his/her stroke, the player needs to expand sideway during hitting phase leading to lower stroke speed (loss of power). This can also change his/her stoke intention (instead of hitting a winner to avoid the error); which would suggest that number of rally shots would be higher in the LS if the fatigue from previous matches is present. However, according to our results we can speculate that fatigue from previous matches was not present.

The study was limited by the sample size of matches in each round of the tournament. As limited number of players left in the last tournament rounds, such players were observed several times. The results can be influence by individual playing style and strategy but in spite of that we observed large number of points and we believe these results bring useful information. The rally pace can be affected by various factors; such as individual playing style of opposing players, their tactics and strategy, by weather conditions and fatigue etc. If a player uses a second serve, it may result in different initial rally pace due to lower serve speed and different technique (Reid et al., 2016; Xavier et al., 2017). On the other hand, second serve may allow a faster return shot. Also different ball brand and court surface can affect the rally pace, work to rest ratio, point duration and other match characteristics, but these hypotheses need to be confirmed.

Conclusion

Differences between the ES and LS of the Australian Open 2017 were apparent showing faster rally pace and shorter rallies in the LS. The most successful players of this tournament had, and provided the opponents with less time after the ball was struck. And those players finished the rally within four shots in 69 %, which suggests the importance of the first two shots of each player. These findings can be used by coaches and players to adopt useful strategy or playing style in their practice sessions and matches.

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