

Sánchez-Pay, A.; Ortega-Soto, J.A.; Courel-Ibáñez, J.; Sánchez-Alcaraz, B.J. (202x) Tennis Service Performance In Professional Women Players: Influence of Ranking Position and Opponent's Laterality. Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte vol. X (X) pp. xx. <http://cdeporte.rediris.es/revista/>___*

ORIGINAL

EL SERVICIO EN TENIS PROFESIONAL FEMENINO: INFLUENCIA DEL RANKING Y LA LATERALIDAD

TENNIS SERVICE IN PROFESIONAL WOMEN PLAYERS: INFLUENCE OF RANKING POSITION AND PLAYERS' HAND-DOMINANCE

Sánchez-Pay, A.¹; Ortega-Soto, J.A.²; Courel-Ibáñez, J.¹; Sánchez-Alcaraz, B.J.¹

¹ Doctores en Ciencias de la Actividad Física y el Deporte. Facultad de Ciencias del Deporte. Universidad de Murcia aspay@um.es, courel@um.es, bjavier_sanchez@um.es

² Graduado en Educación Primaria. Universidad de Murcia (Spain)
joseantonioortegasoto@gmail.com

Spanish-English Translator: Pablo Touchard Pelluz, pabloutouchard@gmail.com

Código UNESCO / UNESCO code: 5899. Otras Especialidades Pedagógicas (Educación Física y Deporte)

Clasificación Consejo de Europa / Concil of Eurpe classification: 4. Educación Física Y Deporte Comparado / Physical Education And Sport Compared

Recibido 31 de marzo de 2020 Received March 31, 2020

Aceptado 30 de enero de 2021 Accepted January 30, 2021

ABSTRACT

Despite the fact that service is the most important stroke in modern tennis, the number of studies on professional women's tennis is scarce. The aim of the present study was to identify differences in service direction and effectiveness regarding players' ranking position; as well as observe the differences according to the opponent's hand-dominance (right-handed or left-handed). A total of 108 matches from the US Open and Wimbledon tournaments were analysed. Results showed a larger variability in service tactics in Wimbledon compared to the US Open. In addition, the direction and effectiveness of the service of right-handed players differed depending on the opponent's hand-dominance, especially against left-handed players. These results contribute to

the knowledge of the service dynamics and performance in professional women's tennis players.

KEY WORDS: Tactics, racquet sports, game patterns, court surface.

RESUMEN

A pesar de que el saque es el golpe más determinante en el tenis moderno, existen hasta la fecha pocas investigaciones en tenis profesional femenino. El objetivo del presente estudio fue identificar las diferencias en la dirección y eficacia del saque en función del ranking; así como observar las diferencias según la lateralidad de la jugadora rival (diestra o zurda) en torneos de Grand Slam. Se analizaron un total de 108 partidos femeninos disputados en los torneos del Abierto de los Estados Unidos y Wimbledon. Los resultados mostraron una mayor variabilidad en la táctica del saque en Wimbledon frente al Abierto de Estados Unidos. Además, se identificaron diferencias en la dirección y eficacia del saque de las jugadoras diestras en función de la lateralidad del rival, en especial cuando se sacó a jugadoras zurdas. Estos resultados contribuyen al conocimiento de las dinámicas y rendimiento del saque en las jugadoras de tenis profesionales.

PALABRAS CLAVE: táctica, deportes de raqueta, patrones de juego, superficie de juego.

1. INTRODUCTION

Serve and return are two of the most decisive strokes of match outcome in modern tennis (Gillet, Leroy, Thouvarecq, & Stein, 2009). Therefore, most of the main statistical descriptors in this sport refer to these aspects of the game, especially the serve (Whiteside & Reid, 2016). Furthermore, tennis is played on different surfaces. Court surfaces directly influence competition technical demands (Cui, Gómez, Gonçalves, & Sampaio, 2018; Sánchez-Pay, Palao, Torres-Luque, & Sanz-Rivas, 2015) and serve statistics are especially affected (Sánchez-Pay, Giménez-Cárceles, and Sánchez-Alcaraz, 2019). In this sense, in Grand Slam tournaments the players achieve a high percentage of successful first serves (around 60%) and show great skill in the return, especially when they receive the second serve (Cui et al., 2018; Hizan, Whipp And Reid, 2011; Reid, Morgan and Whiteside, 2016).

Likewise, it is observed that the service is more decisive on the fast and medium courts of Wimbledon, the Australian Open and the United States Open than on the clay of Roland Garros (O'Donoghue & Ingram, 2001). In clay courts there are fewer differences in serve statistics between winners and losers, and sometimes they may even favour defeated players (Filipčič et al., 2008).

Furthermore, Gillet et al. (2009) and O'Donoghue & Brown (2008) highlighted the importance of starting the points with the first serve, since it provides a great advantage for the server at the beginning of the rally and the possibility to win the point with an ace. In this sense, players in serve situation win most of the short points (between one or four shots) and, after the fifth shot, the statistics of point outcome are similar between serving and returning players. However, when tennis players start the point with a second serve, there is no advantage in the rally, other than a possible direct serve (O'Donoghue & Brown, 2008). On the contrary, returning players win more points in slower courts, due to the fact that the bounce of the ball allows the tennis players to have more time to react (Cui et al., 2018), and prepare their shots and their trajectories.

However, service statistics can be influenced by other factors such as the altitude of the tournament (Sánchez-Pay, Otálora-Murcia, and Sánchez-Alcaraz, 2019), players' height (Sánchez-Pay, Ortega-Soto, and Sánchez-Alcaraz, 2019), gender (Sánchez-Alcaraz, García-Cambronero, and Courel-Ibáñez, 2018) or ranking (Sánchez-Alcaraz, Perona-Arce, and Courel-Ibáñez, 2018). In this sense, the tennis players classified in the top 25, show significantly higher values in the points won with the first and second serve, points and games won when serving, break points saved and number of aces made, compared to the players classified in the positions 75-100 of the WTA ranking (Sánchez-Alcaraz et al., 2018). In addition, other studies in men's tennis have shown how the percentage of points won on serve seems to be a significant predictor of players' ranking (Barnett, Meyer, & Pollard, 2008).

The interactive nature of tennis means that the laterality of the players has been the object of study (Hagemann, 2009). In this sense, while left-handers make up 10% of the population, the number 1 in the ATP ranking has been occupied by a left-hander 33% of the time in the last 3 decades and 38% in terms of women. Furthermore, 22% and 19% respectively have been finalists in Grand Slam tournaments (Holtzen, 2000). These percentage differences in representation could be determined by the existence of some type of advantage for left-handed players with respect to the skills used in tennis (Hagemann, 2009) given a better neuroanatomical condition and visuospatial and visuomotor capacity (Holtzen, 2000). In addition, other studies have highlighted that left-handed players produce a different effect when hitting the ball, forcing opponents (mainly right-handed) to adjust their stroke by reducing their ability to anticipate (Loffing, Hagemann, & Strauss, 2009). However, research on laterality and serve statistics has been studied just in male professional tennis players (Loffing, Hagemann, & Strauss, 2009); while there is no information related to women's tennis.

This study aims to contribute to the knowledge of the service dynamics in professional tennis players. Therefore, the objective of this study will be to analyze the serve direction and effectiveness according to the players' ranking; as well as to observe the differences in serve statistics of right-handed players according to the opponents' hand-dominance (right-handed or left-handed) in two Grand Slam (Wimbledon and the United States Open).

2. METHOD

2.1. Sample

The sample was made up of 117 matches played in two Grand Slam tournaments: Wimbledon and US Open, both from 2017. A total of 61 matches were recorded at the Wimbledon tournament and 56 matches at the US Open. In both tournaments, matches from the second round were recorded and analyzed. Data from nine matches were not included in the analysis, one of them due to injury to one of the players and eight due to lack of data.

2.2. Procedure and variables

The data were obtained from the official statistics of the website tournament, following the methodology of previous studies (Sánchez-Pay et al., 2015). The data was collected one month after the end of each tournament on their official websites (<http://www.wimbledon.com/index.html> y <https://www.usopen.org>). The variables collected were:

- Ranking: differentiated between Top-10 and other players.
- Tournament: Wimbledon (W) and United States Open (US Open)
- Hand-dominance: right-handed (R) and left-handed (L).
- Serve number: indicates that the values refer to the first or second service opportunity. First service (1st service) or second service (2nd service).
- Court side: represents the place from where the service was made, distinguishing between deuce or advantage (Figure 1).
- Serve direction: shows the place in the service box where the service bounced, divided into wide (W), to the body (B), or to the central area of the court (T) (Figure 1).
- Serve distribution: indicates the percentage of the serves regarding to court side and serve direction.
- Effectiveness: indicates the percentage of points won regarding court side and serve direction.

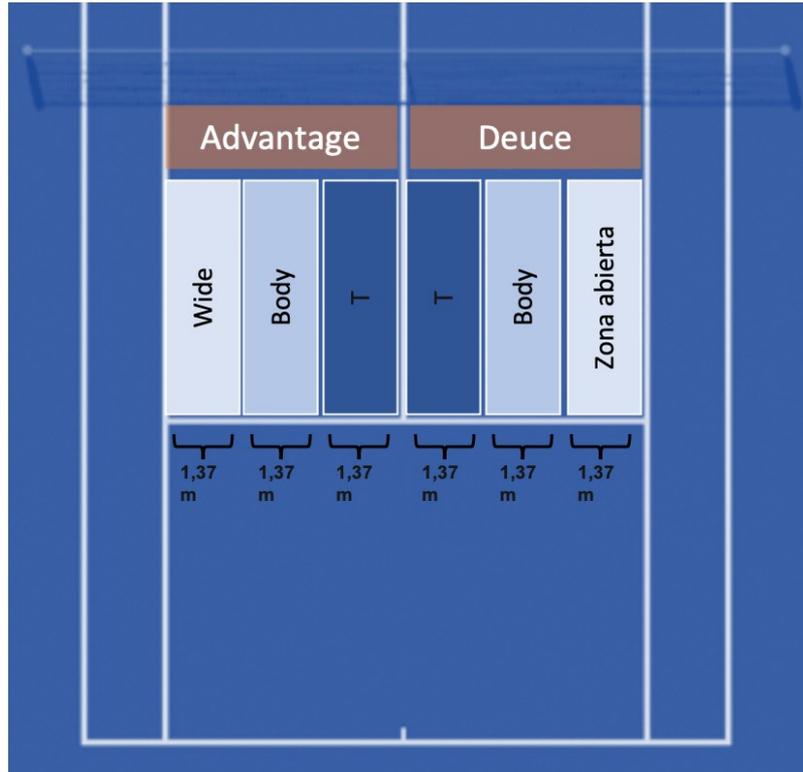


Figure 1. Representation of the court sides (deuce and advantage) and service direction (wide, to the body, and central "T").

2.3. Statistical analysis

The absolute values of the serves performed in each zone, as well as the points won by serving to each zone, were converted into percentages, and the mean (M) and standard deviation (SD) were calculated. Kolmogorov Smirnov was used to check the distribution of the data. The nonparametric Mann-Whitney U test was used to determine the differences in direction and efficacy between the ranking variables. In addition, the Wilcoxon test was used to compare the laterality of the players in the matches that faced two right-handed tennis players (R vs R) and a right-handed and a left-handed tennis player (R vs L). Significance was established at $p < 0.05$. The analyses were performed with the IBM SPSS 20.0 statistical package for Windows (Armonk, NY: IBM Corp.).

3. RESULTS

Table 1 shows the differences in serve directions and percentage of points won when players serve. At Wimbledon, the Top-10s directed more first serves to the T [$Z = 50.95$, $p < 0.01$] and more second serves to the body [$Z = 46.21$, $p < 0.01$] in the deuce side. In addition, the Top-10 won more points with the first serve to the T area both to the deuce side [$Z = 51.81$, $p < 0.01$] as advantage side [$Z = 48.09$, $p < 0.05$], while with the second serve they were more effective when serving to the body area in the deuce side [$Z = 47.24$, $p < 0.05$]. On the contrary, the rest of the players served more wider first serves to the deuce side [$Z = 49.79$, $p < 0.01$] and won more points with first wide serves to the deuce

side [Z = 50.01, p <0.01] and the advantage side [Z = 49.45, p <0.05]. At the US Open, the Top-10s played more second wide serves into the advantage side than the rest of the players [Z = 19.39, p <0.01].

Table 1. Differences in serve statistics between Top-10 and the rest of the players at Wimbledon and the US Open.

Distribution and effectiveness	Serve	Court Side	Dir.	Wimbledon		US Open	
				TOP-10	REST	TOP-10	REST
				Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Distribution	1 ^{er} S	Deuce	W	37,8 (15,05)	49,8 (12,3)**	32,3 (13,4)	34,4 (15,5)
			B	11,2 (10,6)	13,1 (10,5)	29,9 (16,7)	32,5 (19,2)
			T	50,9 (12,9)**	37,1 (13,0)	38,0 (11,5)	33,0 (14,6)
		Advantage	W	42,4 (18,0)	49,9 (13,8)	36,1 (12,0)	38,3 (15,0)
			B	11,8 (11,6)	12,5 (10,5)	30,3 (17,4)	26,9 (16,9)
			T	45,8 (20,0)	37,5 (15,7)	33,5 (18,4)	34,7 (18,3)
	2 ^o S	Deuce	W	25,9 (27,3)	32,1 (24,4)	17,7 (17,7)	12,3 (14,3)
			B	46,2 (22,7)**	35,3 (21,2)	63,5 (19,6)	62,7 (24,2)
			T	27,8 (25,2)	32,5 (26,0)	18,7 (22,0)	24,9 (21,7)
		Advantage	W	28,8 (25,6)	23,8 (22,9)	9,4 (16,9)**	10,1 (14,3)
			B	39,1 (24,8)	35,1 (22,1)	57,4 (21,6)	56,0 (26,1)
			T	32,0 (30,6)	41,1 (25,2)	23,1 (26,4)	33,7 (26,3)
Effectiveness (%)	1 ^{er} S	Deuce	W	37,2 (18,1)	50,0 (15,1)**	33,8 (13,2)	36,3 (18,1)
			B	10,9 (11,1)	12,7 (12,4)	25,8 (18,5)	29,2 (20,4)
			T	51,8 (15,3)**	37,2 (16,4)	40,3 (13,2)	34,4 (15,8)
		Advantage	W	41,1 (19,2)	49,4 (17,3)*	34,8 (12,9)	40,1 (17,5)
			B	10,7 (12,8)	11,7 (10,8)	29,9 (20,9)	24,4 (18,0)
			T	48,1 (20,8)*	38,8 (18,4)	35,3 (18,6)	35,4 (20,6)
	2 ^o S	Deuce	W	26,1 (32,1)	33,6 (29,0)	20,6 (20,9)	13,7 (18,2)
			B	47,2 (29,1)*	34,2 (26,8)	59,3 (22,1)	60,7 (29,2)
			T	26,6 (27,8)	32,1 (31,0)	20,0 (22,2)	25,5 (26,4)
		Advantage	W	28,3 (29,3)	23,6 (28,9)	18,9 (20,8)	11,3 (19,3)
			B	40,9 (28,2)	33,8 (29,7)	58,1 (26,6)	52,5 (30,0)
			T	30,6 (31,2)	41,3 (31,5)	22,9 (29,5)	36,1 (30,0)

Note: SD: Standard Deviation; S: Serve; W: Wide area; B: Body area; T: centre area "T"; Dir: Serve direction.

* Statistical differences (Wilcoxon): * p <0.05; ** p <0.01

Table 2 shows the differences in the serve distribution and percentage of serving points won according on the hand-dominance of the opponents. At Wimbledon, more wide serves were played at left-handed players in the deuce side, both with the first serve [Z = 59.15, p <0.01], and with second serve [Z = 56.08, p <0.01], and to the advantage side in the second serve [Z = 41.56, p

<0.05]. In addition, more points were won with the first service to wide area in the deuce side [Z = 60.39, p <0.01] and with the second serve to wide area in the advantage side [Z = 43.15, p <0.05]. Against right-handed opponent's, more second serves were played to the T area to the advantage side [Z = 39.61, p <0.01], being also the area where more points were won [Z = 38.62, p <0.05]. At the US Open, against left-handed opponents in the advantage side, the players played the first serves to the body [Z = 40.02, p <0.05] while the second serves were to wide area [Z = 29.55, p <0.01], being the latter where more points were won [Z = 28.86, p <0.01]. Against right-handed rivals, players play more second serves to the T into the advantage side [Z = 35.01, p <0.01], being also the most effective combination [Z = 37.14, p <0.01].

Table 2. Right-handed players serve statistics based on the laterality of their opponents at Wimbledon and the US Open.

Distribution and effectiveness	Serve	Court Side	Dir.	Wimbledon		US Open	
				R vs R	R vs L	R vs R	R vs L
Distribution and effectiveness	1 ^{er} S	Deuce	A	45,4 (13,6)	59,1 (12,7)*	34,9 (15,57)	28,3 (9,9)
			C	12,4 (9,6)	10,1 (14,1)	31,8 (19,14)	39,8 (20,6)
			T	42,1 (14,1)	30,7 (16,4)	33,2 (14,33)	31,8 (14,1)
		Advantage	A	49,1 (14,8)	48,5 (10,2)	38,6 (14,94)	37,8 (11,1)
			C	12,3 (10,5)	13,7 (13,9)	26,4 (16,7)	40,0 (15,1)*
			T	38,5 (16,7)	37,6 (18,9)	34,9 (17,84)	22,1 (15,0)
	2 ^o S	Deuce	A	29,8 (25,0)	56,0 (17,6)*	13,5 (14,12)	15,9 (23,1)
			C	39,5 (22,7)	30,9 (19,9)	60,4 (23,38)	73,3 (23,6)
			T	30,6 (25,4)	13,0 (11,9)	26,0 (22,71)	10,7 (8,6)
		Advantage	A	25,4 (23,7)	41,5 (21,6)*	9,9 (13,04)	29,5 (19,5)**
			C	34,9 (22,8)	42,9 (16,7)	55,0 (25,74)	60,9 (15,1)
			T	39,6 (27,2)*	15,4 (16,4)	35,0 (26,49)**	9,5 (8,7)
Effectiveness (%)	1 ^{er} S	Deuce	A	45,0 (16,3)	60,4 (20,5)*	36,7 (17,68)	30,5 (11,8)
			C	12,0 (11,1)	8,8 (14,1)	28,7 (20,24)	34,6 (22,6)
			T	42,9 (16,9)	30,8 (20,1)	34,5 (15,2)	34,7 (17,3)
		Advantage	A	48,5 (17,8)	43,7 (14,9)	39,7 (17,86)	41,6 (10,9)
			C	11,5 (11,4)	13,7 (12,9)	24,8 (18,44)	33,1 (19,8)
			T	39,8 (18,9)	42,5 (22,2)	35,5 (20,06)	25,1 (17,6)
	2 ^o S	Deuce	A	31,6 (30,2)	49,7 (27,3)	15,4 (18,43)	17,1 (24,6)
			C	38,8 (28,0)	36,9 (31,7)	58,0 (28,33)	73,6 (28,5)
			T	29,5 (29,7)	13,3 (15,0)	26,5 (26,67)	9,2 (12,1)
		Advantage	A	25,1 (29,4)	43,1 (26,8)*	11,2 (17,91)	28,8 (23,2)**
			C	36,2 (30,2)	40,1 (19,2)	51,6 (29,48)	64,9 (21,3)
			T	38,6 (31,5)*	16,7 (19,6)	37,1 (30,22)**	6,2 (9,9)

Note: SD: Standard Deviation; S: Serve; W: Wide area; B: Body area; T: centre area "T"; Dir: Serve direction.

* Statistical differences (Wilcoxon): *p <0.05; **p<0.01

4. DISCUSSION

The importance of the service has been highlighted in previous studies that have used a wide variety of methods for its analysis (O'Donoghue & Brown, 2008). The serve is considered the most relevant shot of the game since it produces the advantage to win the rally, starting in an offensive position, or directly through an ace (Gillet et al., 2009).

The objectives of this study were to describe differences in service direction and effectiveness between Top-10 and the rest of the players at Wimbledon and the United States Open, regarding opponents' hand-dominance. In this sense, the results showed that in Wimbledon there was greater variability between both groups of tennis players in the direction and the percentage of points won with the service than in the United States Open. It was also noted that right-handed servers hit more serves to the T when they played against right-handed players, and more open serves when they played against left-handed players.

Top-10 vs rest of players

The results showed that in the United States Open there are no great differences in serves' direction and effectiveness regarding players' ranking, while in Wimbledon there are notable differences between both groups of players (top 10 and rest of the players). Therefore, it could be said that the court surface influences the percentage of points won, since the serve has a greater impact and is more decisive on the grass surface of the Wimbledon tournament (Barnett, Meyer & Pollard, 2008; Barnett & Pollard, 2007).

At Wimbledon, the main differences between the Top-10 and the rest of the players are in the direction and effectiveness rates of the first serve. In this way, the first players in the ranking hit the first serve to the T more frequently, while the other players used open serves. This could be explained because the Top-10 try to "close the direction angles in the court" so that the opponent has less chance to hit with a wide angle, while the other tennis players prefer to move their rivals off the court. In both cases, the players try to find the sides of the service box to make it difficult for the opponents to return the ball (Hizan, Whipp & Reid, 2015). These preferences, regarding the direction of the first serve, seem to be effective, since statistically significant differences favorable to both groups of tennis players are registered in these areas of the court.

On the other hand, it should be noted that there are no significant differences between the Top-10 and the rest of the players in the direction and effectiveness of the second serve. However, it is observed that female tennis players use the service to the body more frequently when they start the game with this service, since there is less chance of making a double fault (Hizan et al., 2015), as the risk of the ball going over one of the lateral lines is considerably reduced.

In the United States Open, there are no relevant differences in serve statistics between the Top-10 and the other players. However, it is noteworthy that in this tournament both groups of tennis players use the serve to the body with the same frequency as the open serves and to the T in the case of the first serve, being used as the main option with the second service. These data are consistent with previous studies that highlight the high percentage of serves directed to this area of the service box (Cui et al., 2018).

Right-handed serving players vs Right/Left-handed returning players

Results showed that there are more differences in Wimbledon than the US Open in serve statistics. This could be due to the fact that, on a grass surface, servers vary their shot directions more, depending on the laterality of their opponents, while on slower DecoTurf's courts they tend to maintain a strategy regardless of whether the opponents are right-handed or left-handed.

At Wimbledon, serving players use more open and T first serves on both sides against right- and left-handed opponents, while hardly using the body service. One possible explanation is that the servers try to send the ball away from the returning players, trying to combine direction and power to make the return as difficult as possible on the fastest court surfaces (Hizan et al., 2015).

It is noteworthy that against left-handed tennis players, right-handed servers lead significantly more open first serves in deuce court. This strategy seems to be effective, since as reflected in the data, they win a large percentage of the points when the serve in this side of the court. This could be due to the fact that right-handed tennis players are able to open more angles in this service box and to move their opponents out of the court, which is a disadvantage for left-handed players who are forced to return with the backhand in a very difficult situation.

With the second serve, the right-handed tennis players use the same tactic of hitting open services when playing in deuce court against left-handed opponents. This strategy is also effective, but not to the same degree as with the first serve. This could be explained due to the fact that professional tennis players hit the ball with a slower speed in the second serve (Cui et al., 2018; Barnett et al., 2008; O'Donoghue & Ingram, 2001), so the returning players have more time to react.

On the other hand, the differences in second serve statistics are especially interesting, both in the direction and in the percentage of points won when players serve in the advantage side of the court. This could be due to the fact that the right-handed servers, when they play in a disadvantaged score, and with the risk of starting the point with the second serve, hit the serve towards the dominant side of the returner (hitting the forehand), trying to avoid the powerful two-handed backhand characteristic of elite female tennis players (Hizan et al., 2015). This same situation also occurs with the second serve at

the United States Open, both in the direction and in the percentage of points won in the advantage side of the court.

In addition, in the United States Open, the players used the serve to the body more frequently, especially with the second serve. The differences with the first serve may be due to the fact that in the grass court of Wimbledon the strategy of the players focuses on achieving a direct serve, so they hit to the sides of the service box, while in the medium speed courts of DecoTurf the tactic is based on forcing the error of the rivals, trying to surprise them by alternating directions. In the case of the second serve, it may be due to the fact that the surface of the US Open makes this serve even weaker, so the players try to reduce the reaction time of the opponents by hitting the serve to their body, ensuring that they can't hit the return in a good position.

This study has some limitations that must be taken into account when interpreting the results. In this sense, although the difference in the direction of the serve in right- and left-handed players has been analyzed, the percentages of effectiveness in the serve have not been compared, taking into account players' hand-dominance. In this sense, previous studies have shown how left-handed players obtain significantly higher values in the percentage of points won with the first serve and the second serve than right-handed players in professional tennis (Sánchez-Alcaraz, Courel-Ibáñez, Fernández-Amor, Sánchez-Pay, and Alfonso-Asencio, 2019). However, it is necessary that future studies analyze the data presented in this research, since up to now there has been little research on the different strategies that tennis players can use based on these variables: serving player's hand-dominance, returning player's hand-dominance and court surface. As a second limitation, data has only been collected from two Grand Slam tournaments, on grass (Wimbledon) and DecoTurf (US Open), but data on slow surfaces such as clay have not been analyzed. Finally, the score has not been taken into account in this research, and the players can change their game pattern according to the importance of each point.

5. CONCLUSIONS

Based on the current results, the following conclusions are established related to the differences in the serve direction and effectiveness regarding players' ranking and opponents' hand dominance in two Grand Slam tournaments (Wimbledon and US Open):

- At Wimbledon there is great strategic variability between the Top-10 and the rest of the players in the ranking, while at the US Open there are hardly any differences between both groups of tennis players.
- At Wimbledon, the main strategic difference between the Top-10 and the rest of the players is the direction they play to the first serve, making for opposite but equally effective tactics.

- In the US Open there are no differences between the Top-10 and the rest of the players in the ranking.
- Right-handed servers adapt the direction of their serves depending on the laterality of their opponents and the court surface (US Open and Wimbledon).
- When right-handed servers play with the second serve in the advantage side against right-handed players, there is a higher percentage of serves played to the "T", while against left-handed players they do it preferably to the wide area of their opponents.

6. PRACTICAL APPLICATION

This information may constitute a useful guide to analyse the behaviours of professional tennis players in Grand Slam tournaments, with important practical applications for coaches and players to adapt tactical strategies focusing on those key aspects for the development of matches based on the characteristics of each tournament.

Thus, the differences regarding the serve direction and effectiveness between the Top-10 and the rest of the players will allow the tennis players to adapt their strategy depending on the opponents, also considering the variability depending on the tournament.

In this sense, the returners must consider the serving preferences of the right-handed players based on their own laterality. In this way, they can anticipate their opponents and position themselves better on the court, trying to get a winning return or begin the rally with an advantage.

7. REFERENCES

- Barnett, T., Meyer, D. & Pollard, G. (2008). Applying match statistics to increase serving performance. *Medicine and Science in Tennis*, 13(2), 24-27.
- Barnett, T., & Pollard, G. (2007). How the tennis court surface affects player performance and injuries. *Medicine Science Tennis*, 12(1), 34–37.
- Cui, Y., Gómez, M.-Á., Gonçalves, B., & Sampaio, J. (2018). Performance profiles of professional female tennis players in grand slams. *Plos One*, 13(7), e0200591. <https://doi.org/10.1371/journal.pone.0200591>
- Filipčič, T., Filipčič, A., & Berendijaš, T. (2008). Comparison of game characteristics of male and female tennis players at Roland Garros 2005. *Acta Universitatis Palackianae Olomucensis. Gymnica*, 38(3).
- Gillet, E., Leroy, D., Thouvarecq, R., & Stein, J.-F. (2009). A notational analysis of elite tennis serve and serve-return strategies on slow surface. *Journal of Strength and Conditioning Research*, 23(2), 532–539. <https://doi.org/10.1519/JSC.0b013e31818efe29>

- Hagemann, N. (2009). The advantage of being left-handed in interactive sports. *Attention, Perception, & Psychophysics*, 71(7), 1641–1648. <https://doi.org/10.3758/APP.71.7.1641>
- Hizan, H., Whipp, P., & Reid, M. (2011). Comparison of serve and serve return statistics of high performance male and female tennis players from different age-groups. *International Journal of Performance Analysis in Sport*, 11(2), 365–375. <https://doi.org/10.1080/24748668.2011.11868556>
- Hizan, H., Whipp, P., & Reid, M. (2015). Gender Differences In The Spatial Distributions Of The Tennis Serve, 10(1), 87–96.
- Holtzen, D. W. (2000). Handedness and Professional Tennis. *International Journal of Neuroscience*, 105(1–4), 101–119. <https://doi.org/10.3109/00207450009003270>
- Loffing, F., Hagemann, N., & Strauss, B. (2009). The serve in professional men's tennis: effects of players' handedness. *International Journal of Performance Analysis in Sport*, 9(2), 255–274. <https://doi.org/10.1080/24748668.2009.11868482>
- O'Donoghue, P., & Brown, E. (2008). The importance of service in grand slam singles tennis. *International Journal of Performance Analysis in Sport*, 8(3), 70–78. <https://doi.org/10.1080/24748668.2008.11868449>
- O'Donoghue, P., & Ingram, B. (2001). A notational analysis of elite tennis strategy. *Journal of Sports Sciences*, 19(2), 107–115. <https://doi.org/10.1080/026404101300036299>
- Reid, M., Morgan, S., & Whiteside, D. (2016). Matchplay characteristics of Grand Slam tennis: implications for training and conditioning. *Journal of Sports Science*, 34(19), 1791–1798. <https://doi.org/10.1080/02640414.2016.1139161>
- Sánchez-Alcaraz, B.J., Courel-Ibáñez, J., Fernández-Amor, J.L., Sánchez-Pay, A., & Alfonso-Asencio, M. (2019). Diferencias en las estadísticas de competición de tenis en los Juegos Olímpicos de Río de Janeiro 2016. *Revista Iberoamericana de Ciencias de la Actividad Física y el Deporte*, 8(3), 1-12.
- Sánchez-Alcaraz, B.J., García-Cambronero, S. y Courel-Ibáñez, J. (2018). Diferencias en el servicio y resto en el top-8 del ranking masculino y femenino de tenis. *ITF, Coaching and Sport Science Review*, 76(26), 13-15.
- Sánchez-Pay, A., Giménez-Cárceles, J.M. y Sánchez-Alcaraz, B.J. (2019). Diferencias en la distribución espacial del saque en función del rendimiento y tipo de superficie. *Kronos*, 18(2), 1-13.
- Sánchez-Pay, A., Ortega-Soto, J.A. y Sánchez-Alcaraz, B.J. (2019). Influencia de la altura en el rendimiento del saque en el tenis femenino profesional. *ITF, Coaching and Sport Science Review*, 79(27), 6-8.
- Sánchez-Pay, A., Otálora-Murcia, F.J., y Sánchez-Alcaraz, B.J. (2019). Influencia de la alta altitud en las demandas de competición del tenis profesional en pista dura y tierra batida. *Cultura, Ciencia y Deporte*, 14(42), 243-249.

- Sánchez-Alcaraz, B.J., Perona-Arce, F., y Courel-Ibáñez, J. (2018). Parámetros de rendimiento en el servicio y resto del top-100 femenino en tenis. *Kronos*, 17(1), 1-7.
- Sánchez-Pay, A., Palao, J. M., Torres-Luque, G., & Sanz-Rivas, D. (2015). Differences in set statistics between wheelchair and conventional tennis on different types of surfaces and by gender. *International Journal of Performance Analysis in Sport*, 15(3), 1177–1188. <https://doi.org/10.1080/24748668.2015.11868860>
- Whiteside, D., & Reid, M. (2016). Spatial characteristics of professional tennis serves with implications for serving aces : A machine learning approach, 0414(May). <https://doi.org/10.1080/02640414.2016.1183805>

Referencias totales / Total references: 21 (100%)

Referencias propias de la revista / Journal's own references: (0 %)

PENDIENTE DE PUBLICACIÓN / IN PRESS