

Types of serve stance and height of players. A study of the best servers in history

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ABSTRACT

One of the most important performance indicators in tennis is the serve. While recognising the great relevance of this stroke, the objectives of this study were to investigate: the effect of the height of the players on the serve, the two types of stances in the serve (feet up and feet back) and, finally, to study if there was a relationship between the height of the players and the use of these stances in the serve. All this, on a sample of the 50 best servers by effectiveness in the height of the tennis player in the service. In addition, 72% of these best servers used the feet up stance, which implies greater advantages of this stance over the feet back stance. Finally, it was observed that the taller the players were, the more they used the feet up stance. On the other hand, the shorter the height of the players, the more frequently they used the foot back stance. Based on these results, it could help coaches to recommend one stance or the other, depending on the height and style of play of the players.

Key words: Service, height, foot up, foot back

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INTRODUCTION

Tennis is a sport in which there are many different types of strokes such as the serve, the return, the forehand, the backhand, the volley.... If we add to all these strokes that can be executed with different types of effects, directions, depths, heights, and speeds, we find that there are countless variables or ways of hitting the ball, which increases the complexity of the sport in terms of perception and response to stimuli, reading the ball, anticipation, decision-making, reaction, etc. Therefore, as has already been commented in the literature, tennis is a sport of open skills (Crespo & Miley, 1999).

Considering the large number of shot types that exist in tennis, specifically in Grand Slam tournaments, it has been observed that the strokes that occur the most during play are forehand (28%) and backhand (23%) groundstrokes, followed by first serve (19%), backhand return (12%), forehand return (9%) and second serve (7%) (Whiteside & Reid, 2017).

If we must choose the stroke that has the most influence and is the most decisive in the game, it would be the serve. In tennis, every point usually starts with a serve and a return. For this reason, having a great serve allows you to start points on serve with a considerable advantage over your opponent, as you can create space and openings that allow you to press or win the point with the next shot (serve+1). Furthermore, it is also possible to force short returns that allow the server to attack and dominate the point, or directly obtain direct points on serve (Crespo and Miley, 1999). Even, as can be seen in the work of (Whiteside and Reid, 2017), if we count the first and second serves together, the serve would be the second most frequently produced shot (26%), only behind the forehand return.



Today, the serve has acquired even more relevance, as the average number of strokes per point played is currently lower (4.7 strokes per point) according to Carboch et al. (2019). Furthermore, these authors indicated that in three of the four Grand Slams, more than 50% of all points were finished in the first 4 shots (Wimbledon 66%, Australian Open 58%, Roland Garros 52%). Therefore, considering the statistics, today's tennis would be largely made up of the serve, the return and a couple of other shots. For this reason, the service has a considerable importance in the development of the game and, as such, it is necessary to study it to achieve improvements that, even if they are minimal, can make a big difference, especially in high performance.

The serve, observed in isolation, is the only shot in our sport that depends entirely on ourselves, as the opponent does not intervene. In order to develop a great serve, it is obvious that many factors play a role, such as the correct biomechanics of the stroke, especially the coordination of the entire kinetic chain from the bottom (the feet) to the top (the wrist), as well as the proper execution of the phases of the stroke, a precise ball toss, and a good strength-power work of both the lower and upper body to be able to hit with more speed and precision, which is very important in elite tennis (Elliot et al. 2003).

In this research we will study two factors that affect the effectiveness of the serve, one of which is not possible to influence or change in the players, which is their height. On the other factor it is possible to influence, the stance that is performed before the bending of the knees to serve. This stance can be of two types: with feet up also called "pinpoint" and with feet back or also called "platform". Thus, we will study which of them occurs more frequently in the 50 best servers in history, according to a statistic from the ATP. Finally, we will relate the variable of the height of the players with the two types of stances used. We will try to find out if there is a correlation or a more marked (statistically significant) use of one or the other type of stance in the serve, depending on the height of the players.

METHODOLOGY AND PROCEDURE

Subjects

The sample to conduct the study consisted of 50 ATP professional tennis players, both active and retired. The sample was taken from an ATP statistic dated 5 February 2021, which included the best servers in history organised in a numerical ranking, according to a service effectiveness statistic, in which the following service variables were evaluated: percentage of first serve, percentage of points won on first serve, percentage of points won on serve, percentage of games won on serve, average number of direct serves per match and average number of double faults per match. From this service effectiveness ranking, which consisted of 735 players, the top 50 servers were selected for the study.

Material

The statistical programme Jamovi, version 1.6.13, was used. In addition, we used the statistical information collected from the 50 best servers in the history of the ATP, their profile (where their height appeared) and videos of matches of each of them in which we could observe the type of stance in the service that they used.

Analysis variables

The variables used were the quantitative variable of height, measured in metres, the qualitative variable of types of stance in the service, categorised into two groups; feet up and feet back. And finally, a qualitative variable that we called type of height, categorised into two groups; very tall (players who were taller than 1.90m) and tall (players who were shorter than 1.90m).

Procedure and statistical analysis

First, we searched for the statistics of the best servers in the history of the ATP in terms of their effectiveness in serving, selecting the top 50. Then, by entering their ATP profiles, we collected data on their height (m). Next, matches of each

player, in which at least 5 serves were observed, were watched to determine, and collect the type of stance used.

Secondly, a descriptive analysis of the data obtained for the height variable of the players was carried out, calculating the mean, median, mode, standard deviation, range, maximum, minimum and percentiles for the entire sample (N=50). Next, absolute and relative frequency tables were made for the variables of height type (tall and very tall) and type of stance (feet up and feet back). Next, a contingency table was calculated by crossing the qualitative variables of type of stance and type of height, to study the degree of relationship between these two variables, using Chi square, used to analyse the dependence or independence of the variables. Afterwards, and given that in the Shapiro-Wilk normality test the distribution of the height variable (m) was different from normal (S-W p<0.05), the non-parametric Mann-Whitney U test was performed to compare this variable height in the two types of stance in the service and to study if there were significant differences between tennis players who use the stance of separated feet and those who use the feet up stance in the service. A significance level of p<0.05 (5%) was established throughout the study.

RESULTS AND DISCUSSION

Height of the 50 best servers in history

One of the objectives of this article was to study the height of the 50 best servers in history and to study its relevance in service performance. To determine this, we analysed the descriptive parameters of the height variable (m) in the sample (N=50). As can be seen in table 1, the average height of these 50 players with the highest service effectiveness is 1.94m, with the tallest players being 2.11m (maximum), both Ivo Karlovic and Reilly Opelka, who are 2nd and 3rd in this ranking of service effectiveness, only behind John Isner who is the leader of the ranking with 2.08m. And, therefore, the three players with the highest height are in the top 3 of the ranking of service effectiveness. The shortest player in the rankings is Andre Agassi at 1.80m (minimum).

Table 1

Descriptive statistics of the variable height (m) in the 50 best servers in history (ATP).

Descriptive	Height (m)
N	50
Lost	0
Mean	1.94
Median	1.93
Mode	1.96
Standard Dev	0.0657
Range	0.310
Minimum	1.80
Maximum	2.11
25 percentile	1.88
50 percentile	1.93
75 percentile	1.96

Table 2

Binomial test of frequencies of the variable type of height (very tall (+1.90m) and tall (-1.90m)).

	Level	NO.	Total	Proportion	р
Turne of height	Very tall (+1.90m)	36	50	0.720	0.003
	Tall (-1.90m)	14	50	0.280	0.003

Note: H, is ratio. ≠ 0.5

In addition, it can also be observed that the most repeated height (mode) is 1.96m, found in up to 12 players of these 50. As can be seen in table 2 of frequencies, 72% of players in this classification of service effectiveness are taller than 1.90m, which is significant in relation to the 28% who are below 1.90m.

Furthermore, comparing with other studies, we note that, if we take the average height of the 50 best servers in history by effectiveness, which is, as we mentioned, at 1.94m, we observe that it is greater than the 1.88m average of the first 50 players in the ATP ranking, and substantially greater than the 1.85m average of the players from 51 to 100 in the ATP ranking (Leiting, 2015).

In a study by Dobos & Nagykáldi (2017) in elite junior male and female players, a strong positive correlation was found between the distance the ball was tossed high and the maximum speed of the ball on the serve (an indicator of serving performance), with the higher the height of the toss, both in girls and boys, the greater the speed of the serve, and this reinforces, as we already know, the importance of hitting the ball as high as possible on the serve. We can state that the greater the height of the players, the higher they will naturally hit the ball and at a greater speed (Vaverka & Cernosek, 2013), since as we observed in the study by Sánchez-Pay et al. (2019), the greater the height of the professional players, the greater service hitting speeds they achieve, thus increasing the percentage of points won with first serves and the number of direct serves. Therefore, we can say that the greater the height of the players, the greater the service performance.

In addition to achieving greater ball speed, having a greater height provides some further advantages in the serve, as the net is less of an obstacle and it is easier to overcome it, as the degree of incidence in taller players is greater, and, therefore, it is easier for them to hit from top to bottom. Also, as they have a greater degree of incidence due to their height, it is easier for them to find more angles and place the ball better,

which gives them a considerable advantage to open the court with their serve and surprise their opponents (Martin, 2015).

To conclude this section, it can be stated that all the data collected allow us to note the importance of height as a clear indicator of service performance, since the greater the height, the higher the service performance parameters increase.

Frequency of the two types of stances in the best servers

The next objective of this study was to investigate the two types of stances ("feet up" and "feet back") in the best servers in history, to see which is the most common and what advantages each may have.

As can be seen in tables 3 and 4, the frequency of players who serve with their feet up among the top 50 most effective servers in history is far higher than those who serve with their feet back. Specifically, there are 36 players who serve with their feet up, representing 72% of the servers, compared to 28% who serve with their feet back (14 players).

Moreover, these data are similar to those of Renoult (2007), who analysed the two stance techniques during the 2007 French Open and the results showed that 72.4 % of the players used the feet up technique. However, when studying the selection of stance according to playing style, it was observed that this percentage changed considerably, with nearly 50% of players who served and volleyed regularly or occasionally (doubles players or attacking players) using the feet back position to serve, compared to only 17% among those who never went to the net after their serve. It was found that when the player was a baseline player, he was much more likely to use feet up stance (83%), and that when the player was more likely to come up to the net the type of stance used was evened out. This proportion could be explained by the advantages provided by each type of stance, as according to Martin (2015) expert players using the feet up technique generate on average more ball speed (173 km/h vs. 166 km/h)

Table 3

Binomial test of frequencies of the variable service stances (feet up and feet back).

	Level	NO.	Total	Proportion	р
Comico otonoo	Feet up	36	50	0.720	0.003
	Feet back	14	50	0.280	0.003

Note: H, is ratio. ≠ 0.5

Table 4

Relative frequencies of the types of stances in the 50 best servers in history (ATP).

Levels	NO.	% of total	% Cumulative	
Feet up	36	72.0%	72.0%	
Feet back	14	28.0%	100.0%	

than with the feet back technique. This represents an average difference of 7 km/h in favour of the feet up technique. Furthermore, following this author, the feet up technique produces a greater ground reaction force than the feet back technique (2.1 times body weight compared to 1.5 times body weight). Consequently, the feet up technique allows players to impact the ball higher than the feet back technique. As we know, the higher the point of impact of the ball, the better it will be over the net, the greater the chance of improving first and second serve percentages and the more likely it is to achieve short and cross-court angles.

On the other hand, the feet back technique would provide us with two other advantages, the first being that, by having a greater base of stance, better balance and stability is achieved in the serve, making it a more appropriate and simpler stance to teach beginner players. The second advantage is that this technique, by rising less upwards than with the feet up technique, causes them to land and stabilise faster (70 ms earlier according to this study), allowing them to go up to the net faster and cover more court sooner. Therefore, this stance will generate greater success among players who tend to go up to the net more, as they will be able to cover the net sooner.

To conclude this section, considering that the majority of these 50 best servers are more modern players, where a faster, offensive and baseline tennis is played, in which the speed and power of the ball is an important factor, we can state that the advantages provided by the feet up stance are greater, and for this reason the much higher percentage of servers who use this stance (72%) could be explained.

Finally, within that 28% of players who stance with their feet back, we find players such as Pete Sampras, Boris Becker and Roger Federer who were known for their frequent use of the serve-volley tactic. This backs up the above data. All this data could help coaches to recommend the use of one or another stance depending on the player's style of play. Thus, it could be recommended, for example, the use of the feet back stance in players who use more serve and volley, as is the case of doubles players. However, in general, observing the best servers, the stance that would be most statistically effective would be the feet up stance.

Relationship of the height variable to the two types of stances

The last objective of this study was to investigate the relationship between the variable height (m), and type of height (very tall=+1.90m and tall=-1.90m) with the two types of stances, in the 50 best servers in history by effectiveness. In this way it could be known if there is a more marked use of one type of stance or another, depending on whether the players are taller.

Table 5.1 shows the contingency values that relate the service stance variables with the types of height. When players are very tall (+1.90m), they use the feet up stance more, specifically 83.3% (30/36) of servers over 1.90m use this stance. On the other hand, players who are less than 1.90m (tall), use the feet back stance more, although not in a differential way, as 57.14% (8/14) use it, compared to 42.86% (6/14) who use feet up.

Observing the Chi-square test in table 5.2, it can be noted that there is a strong dependency relationship between the variables, type of height and type of service stance. It is understood that the greater the height of the players, the more they use the feet up type of stance, and the lower their height, the more equity is found, although the feet back type is used more.

Table 5.1

Contingency table between the variables service stance (feet up and feet back) and height type (very tall and tall).

Type of height					
Service stance	Total				
Feet up	30	6	36		
Feet back	6	8	14		
Total	36	14	50		

Table 5.2

Chi-square test (X²).

	Value	df	р
X ²	8.19	1	0.004
Ν	50		

If we also look at table 6 and figure 1, the average height of the servers using the feet up stance is higher (1.95m) than that of the servers using the feet back stance (1.90m). This difference in height is statistically significant (p<0.05), with a difference of 5 cm between the two groups. Considering the median, the difference would be even greater between the two groups as it is 8 cm higher in the group that stances with feet up. Therefore, these data would stance the previously obtained conclusion that the taller the players are, the more they use the feet up stance to serve.

Table 6.1

Non-parametric Mann-Whitney U. test.

		Statistics	df	р
Height (m)	Student's t-test	2.95	48.0	0.005
	Mann- Whitney U	136		0.011

Table 6.2

Descriptive tests for the variable height (m) of the two service stance groups (feet up and feet back) in the top 50 servers (ATP).

	Group	Ν	Mean	Median	SD	SE
Height	Feet up	36	1.95	1.96	0.0620	0.0103
(m)	Feet back	14	1.90	1.88	0.0584	0.0156



Figure 1. Graph of the mean and median of the variable height (m), in the two service stance groups with feet up and feet back in the 50 best servers.

To conclude this last section of the study, a possible explanation for the fact that the taller the players are, the more they use the feet up stance, could be that the taller the players are, the more they play with a tactical pattern based on powerful and aggressive strokes, basing their game above all on a powerful first serve, to try to take an early advantage and finish the point faster. For this reason, they could benefit more from the extra speed on the serve provided by the feet up stance. In addition, the stronger upward momentum after bending with this stance allows them to hit the ball at a higher point, finding better angles and placement on the serve, to move the ball further away from the opponent when opening the court. These advantages could be more beneficial to these taller servers, in a tennis as powerful as the current one, although with this stance, they have a greater loss of stability and time in repositioning after the serve, making it more difficult to get up to the net. Possibly, although it is more difficult for them to fall and stabilise themselves after the jump on the serve (an advantage provided by the stance with their feet back), they can compensate for this loss of time with a bigger stride the taller they are, and in this way, also get to the net quickly, covering the court well. Therefore, taller players would benefit more from the use of a close-footed stance than a wide-footed stance.

This conclusion is a proposal based on a tactical aspect and other biomechanical and technical factors could also be considered to favour this stance in taller players, which would be an interesting proposal for future study.

CONCLUSIONS

This study emphasises the great importance of player height as an indicator of serving performance. In addition, it allows us to know the existence of a greater predominance of the type of stance with feet up in the service compared to stance with feet back in the best servers by effectiveness in history. And it also indicates that there is a greater frequency of using this type of stance with feet up the taller the players are. This research could help coaches to recommend one type of stance or another on the serve, depending on the height and style of play of the players. Finally, this study leaves the door open to possible future studies that may find other biomechanical or technical-tactical factors that explain the greater predominance of the feet up stance the taller the players are.

CONFLICT OF INTEREST AND FUNDING

The author declares that he does not have any conflict of interest and that he did not receive any funding to conduct the research.

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