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The Journal of Sports Medicine and Physical Fitness 2023 Oct 30
DOI: 10.23736/S0022-4707.23.15291-1

ORIGINAL ARTICLE
EXERCISE PHYSIOLOGY AND BIOMECHANICS

Absence of association between serve and winning point in professional padel

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ABSTRACT

BACKGROUND: The aim of this study was to analyze the efficiency of the serve in relation to different tactical parameters in men's professional padel.
METHODS: A total of 1089 points – from 217 games and 19 sets – from 8 World Padel Tour matches played in 2020 were analyzed by systematic observation.
RESULTS: The results showed that the ordinary number of the set influences the efficiency of the serve (P=0.015) with more points won on serve during the second one, and more points lost during the third one. Differently, no difference emerged for the serve efficiency in terms of situation (P=0.233). Similarly, the serving situation does not affect the efficiency in key points (P=0.097) and in non-key points (P=0.706), producing more equality in Australian formation in key points. The direction of the serve in Australian formation (P=0.351) and conventional (P=0.32) does not affect its effectiveness, without effects for the second shot after the return in Australian formation (P=0.472) and conventional (P=0.458), being in both cases the backhand volley the most frequent stroke, for which the pair lose more points when serving. The number of strokes per point is associated to a higher probability of winning the point, being the number of strokes from 3 to 10 where the serving partner maintains the advantage, losing it from that stroke, in addition, there are no winning points neither with the serve nor with the serve-return.
CONCLUSIONS: There are no significant differences (but only small divergences) in most of the tactical parameters considered in terms of serve efficiency.

(*Cite this article as*: Miguel IM, Muñoz D, Lupo C, Alcaraz BJ. Absence of association between serve and winning point in professional padel. J Sports Med Phys Fitness 2023 Oct 30. DOI: 10.23736/S0022-4707.23.15291-1)

KEY WORDS: Racket sports; Athletic performance; Exercise.

Padel is a racket sport that has undergone a significant increase in popularity in recent years since its origin in the late 1960s.[1] It is currently played in more than 50 countries around the world,[2, 3] with Spain being one of the countries where it has become most popular.[1] The rise of padel in various sporting fields has favored its growth worldwide, promoting its visibility both among amateur players, who aim to improve their physical fitness and mood,[4, 5] and at the professional level by means of a progressive higher number of federal licenses and research studie.[1, 6] Scientific research has mainly focused on the analysis of performance parameters[7] in relation to match success in elite as well as sub-elite competition levels,[7-9] focusing the actions performed in the different areas of the court,[10] as well as both on the final shots in the net zone and on strokes in the baseline zone.[11-14] Moreover, research on padel has also been focused on the actions to recover offensive positions.[15] Nevertheless, no study has been focused on a systematic analysis of the serve and the rest in padel performance. The serve and the serve-return are two technical-tactical actions that have great importance in the outcome of the match in racket sports.[16] In tennis, the serve provides on several occasions the possibility of winning the point directly or obtaining an advantage

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that allows the server to take the initiative of the point,[17, 18] being even more evident this advantage in the initiative of the point in doubles,[19] since the partner of the server is in positions near the net as it happens in padel. However, serve in padel is different from that in tennis due to the rules, which must be at waist height or below after the ball bounces on the ground,[3] preventing the ball from having as much speed as in tennis. However, as in doubles tennis, the partner of the server is at the net from the start of the point, and can adopt two tactical formation: conventional or Australian,[20] thus obtaining an initial advantage by covering net areas from the start, as the winning pair gets 34% more points in this area than the losing pair.[21] Despite the great tactical and technical importance of this stroke, there are several studies that have analyzed the serve from different perspectives, observing the distance travelled by the players during the serve according to the tactical situation they adopt during the serve and the times between the serve and the serve-return.[20, 22, 23] Other studies have focused on the tactical analysis of serve and serve-return directions as a function of court side and serve situation, in addition to serve efficiency according to the experience,[24] number of shots, tactical situation, set and serve-return directions,[25-27] ace and first service effectiveness,[8] with each investigation focusing on a specific variable, but without carrying out a detailed analysis of the effectiveness of the serve in terms of tactical position, type of point, number of games, set number, direction of the serve, second shot after the serve-return and number of shots on the point that would allow us to establish a specific tactic to maintain the advantage on serve, which has acquired great importance after the implementation of the golden point rule due to the increase in the number of breaks per match.[28-30] The analysis of the efficiency of the serve both from the point of view of the serving partner in order to maintain the service advantage, and from the point of view of the return partner whose objective is to be able to get a break, is essential due to the greater number of breaks made by the winning partner.[31] Therefore, the aim of this study is to analyze the efficiency of the serve in relation to different tactical parameters in men's professional padel.

Materials and methods

Experimental approach to the problem

To analyze the effectiveness of the service would help coaches and players in improving their match tactics, training periodization and competition management. The matches analyzed are streamed and subsequently hosted on the World Padel Tour website, from where they were downloaded and saved for observation, collection, and analysis of the data. Thus, the effectiveness of the service was analyzed in relation to different tactical parameters such as tactical position of the serving partner; direction of the serve; set number; type of point; number of shots and type of stroke after rest. The design of this study and the different variables selected will be able to answers our questions about the efficiency of the serve, which will provide a broader knowledge of the padel serve.

Subjects

We analyzed 1089 points spread over 217 games, analyzing a total of 19 sets from 8 matches (2 quarterfinals, 3 semifinals and 3 finals) of the men's World Padel Tour circuit (Marbella Open, Valencia Open, Menorca and Las Rozas de Madrid tournaments) played during the 2020 season. The men players (age = 31.5±4.5 years; stature = 179.7±3.5 cm; body mass = 77.8±2.3 kg) had more than 4 years of experience competing in World Padel Tour tournament, and a mean of 136.3±7.2 matches played. The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of University of Extremadura (154/2020).

Procedures

Serve effectiveness (distinguishing between the serving partner wins the point and the serving partner loses the point), were compared with the different tactical parameters as described in Table I (Figure 1).[11, 20, 26] The data were recorded by systematic observation of the above-mentioned matches, using the specialized software LINCE.[32] Two professionals specialized in padel and in the collection of information through systematic observation participated in the data collection. Each observer analyzed the same set to analyze the inter-observer reliability through the Multirater Kappa Free,[33] obtaining values above 0.80. To ensure the consistency of the data, intra-observer reliability was also evaluated at the end of the observation process, obtaining minimum values of 0.80. The kappa values obtained allowed us to consider the degree of agreement as very high (>0.80).[34]

Statistical analysis

The IBM SPPS 26.0 package was used for data analysis (IBM Corp., Armonk, NY, USA). Firstly, a descriptive exploration of the data obtained was carried out and the frequency (N.) and percentage (%) of the total sample were

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TABLE I.—*Criteria used to analyze the different tactical parameters in padel serve.*[11, 20, 26]

Performance indicator	Criteria
Tactical position of the serving partner according to Ramón-Llín *et al.*[20]	Conventional: the server's partner stands on the opposite side of the court from where the serve is made (Figure 1) Australian: the server's partner stands on the same side of the court from which the serve is made (Figure 1)
Direction of the serve according to Sánchez-Alcaraz *et al.*[26]	Serves directed to the side wall (Figure 1) Serves directed to the "T" (Figure 1)
Set number	Set 1 Set 2 Set 3
Type of point	Key point: a point that defines the outcome of the game (*e.g.*, 40-0; 40-40) Non-key point: a point that does not define the outcome of the game (*e.g.*, 15-0)
Number of strokes	The total number of strokes produced during the point was counted
Type of stroke after rest according to Sánchez-Alcaraz *et al.*[11]	Volley: a shot without a bounce that is made with a short up-and-down movement of the racket. Differentiating between the forehand volley (a shot hit on the player's dominant side) and the backhand volley (a shot hit on the player's non-dominant side). Bandeja: a shot hit without bouncing that is hit from the player's dominant side, usually further away from the net. It is considered an intermediate shot between the smash and the forehand volley, as the point of impact is lower than the flat smash and higher than the volley Flat smash: a shot without a bounce over the player's head, with an up and down motion of the racket with a flat spin Off the wall smash: a shot hit at the back of the court after the ball has bounced on the ground and then on the wall

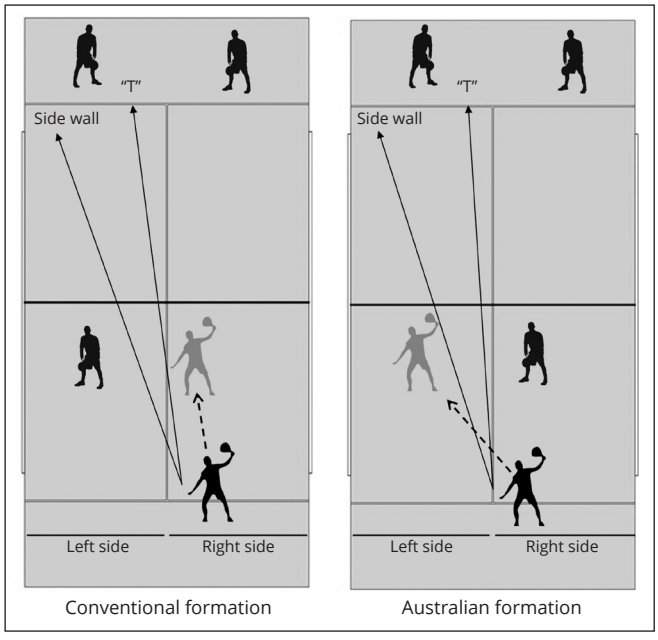

Figure 1.—Delineation of the direction of the serve (side wall or "T") and the conventional and Australian formation.

calculated. Then, to compare serving efficiency and its relationship with the tactical position used, number of sets, type of point, stroke after the return and direction of the serve, the Pearson's χ^2 test was used, with subsequent Z-tests for comparison of column proportions with Bonferroni significance adjustment, with a level of significance in $P \leq 0.05$. Corrected typed residuals (CSR) were calculated to analyze the significance of these relationships.[35] Effect size was calculated from Crammer's V, where values of 0.1 represented a small effect, 0.3 a medium effect and 0.5 and above a large effect.[36]

Results

The descriptive results of point efficiency as a function of different game parameters (Table II) indicate that serving efficiency is not influenced by the tactical situation (χ^2=1.422; df=1; P>0.05; V=0.036), although in both situations, the serving partner wins a higher percentage of points, being 14.2% more in Australian and 21.2% more in conventional. The set in which the match is being played does influence the effectiveness of the serve (χ^2=8.404; df=2; P<0.05; V=0.088), being in the first two sets where there is a 9% higher advantage with respect to the average, increasing by 3.10% in the second set with respect to the first. On the contrary, in the last set, this tendency changes, being the probability of losing the point 1.2% higher than winning it. The tactical situation on the serve also does not indicate that effectiveness depends on which is the type of point (Figure 2). Regarding the key points of a game, the conventional or Australian tactical position does not interfere with the outcome of the point (χ^2=2.762; df=1; P>0.05; V=0.095). However, the probability of winning the point is higher for winning players than losers in both situations (*i.e.*, Australian, +4.9%; conventional, +23%),

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TABLE II.—*Descriptive results of the serving efficiency according to the tactical position and set.*

		Serving efficiency				P value
		Win point		Lose point		
		N. (%)	RSC	N. (%)	RSC	
Tactical position	Australian	291 (57.10%)	-1.2	219 (42.90%)	1.2	0.233
	Conventional	351 (60.60%)	1.2	228 (39.40%)	-1.2	
Set	1	249 (59.0%)	0.0	173 (41.0%)	0.0	0.015
	2	310 (62.10%)	2	189 (37.90%)	-2	
	3	83 (49.40%)	-2.7	85 (50.60%)	2.7	

N.: frequency.

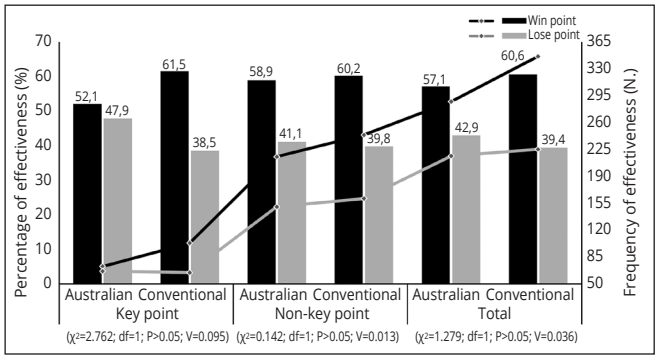

Figure 2.—Serving efficiency according to the tactical position and the type of point.

even though there is a higher probability of winning it in these types of points of 9.4% if the serving partner plays in conventional formation *versus* Australian. Equally, in non-key points of the match, the tactical position does not interfere with the result of the point (χ^2=0.142; df=1; P>0.05; V=0.013). However, there is an absolute (*i.e.*, not significant) difference of 17.8-20.4% of winning the point with respect to losing it. Likewise, although in this type of points the probability of winning the point is still higher in conventional *versus* Australian situation, the serves with Australian position have a higher efficiency (6.8%) compared to the same position during key points. The effectiveness of the serve does not depend on the direction of the serve

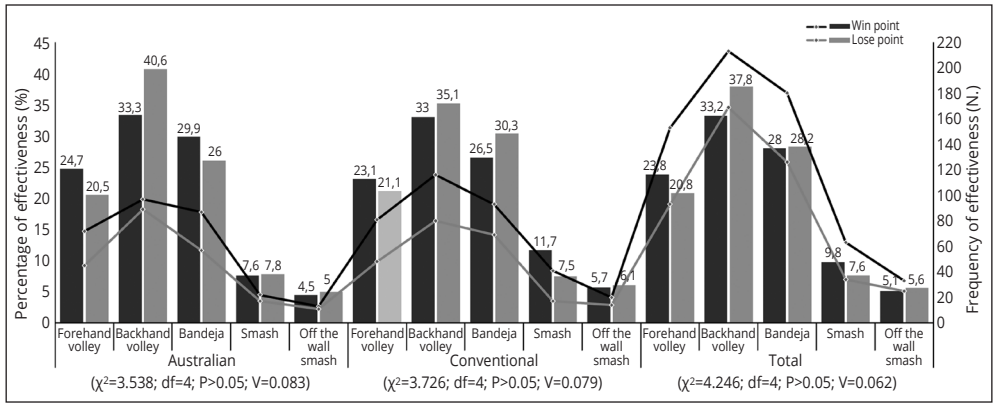

Figure 3.—Serving efficiency as a function of the second shot according to the serving formation.

TABLE III.—*Descriptive results of the serving efficiency according to the tactical position and the direction.*

Tactical position	Direction	Serving efficiency				P value
		Win point		Lose point		
		N. (%)	RSC	N. (%)	RSC	
Australian	Side wall	146 (55.10%)	-0.9	119 (44.90%)	0.9	0.351
	T	145 (59.20%)	0.9	100 (40.80%)	-0.9	-
Conventional	Side wall	242 (59.30%)	-1	166 (40.70%)	1	0.32
	T	109 (63.70%)	1	62 (36.30%)	-1	
Total	Side wall	388 (57.70%)	-1.1	285 (42.30%)	1.1	0.267
	T	254 (61.10%)	1.1	162 (38.90%)	-1.1	-

N.: frequency.

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and the tactical situation used, either Australian (χ^2=0.869; df=1; P>0.05; V=0.041) or conventional (χ^2=0.990; df=1; P>0.05; V=0.041) (Table III). In the Australian formation, although the probability of winning the serve is higher regardless of the direction of the serve, serving to the "T" is 8.2% more likely to win the serve than losing the serve compared to the side wall. In the conventional formation, the side wall receives a large volume of serves, however, in proportion to the number of serves made in each direction, serving to the "T" is 4.4% more likely to win the point than serving to the side wall and similarly 4.4% more likely to lose by serving to the side glass compared to the "T." The effectiveness of the serve is also not conditioned by the second shot after the serve-return in both Australian (χ^2=3.538; df=4; P>0.05; V=0.083) and conventional (χ^2=3.726; df=4; P>0.05; V=0.079) formation (Figure 3). Despite this, it can be observed how in both tactical serving positions, the backhand volley is the predominant stroke, since it is the stroke with which the serving partner is most likely to lose the point with a percentage of 14.6% higher than the following stroke in the Australian formation and 4.8% in the conventional formation compared to the bandeja in both cases. Similarly, this technical stroke is associated to the most winning points (3.4% and 6.5%) in Australian and conventional respectively compared to the second stroke which is the bandeja, thus making these two strokes the predominant ones to perform after the rest. Figure 4 shows the count of the number of strokes and the effectiveness of winning or losing the point on serve. As can be seen, there is a positive correlation between both variables starting with a 42% chance of winning *versus* losing the point in the first 4 strokes and decreasing the probability of winning the point as the number of strokes increases, losing the advantage on serve from the 10th stroke onwards where the probability of losing the point is 4.40% higher than winning it. Similarly, it can be seen that there are no winners neither the serve nor serve-return.

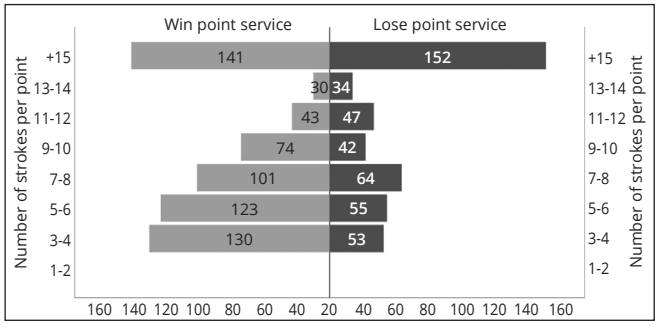

Figure 4.—Count of number of strokes and serving efficiency.

Discussion

The aim of this study was to analyze the efficiency of the serve in relation to different tactical parameters in men's professional padel. The results of the study show that the probability of winning the point on serve is superior to losing it regardless of the tactic used. Previous studies showed how the serve in padel provides an advantage in the point, being greater in men's padel,[23, 26, 27] as occurs in other racket sports such as singles tennis and doubles.[37, 38] The initial serving situation allows players to position themselves from the first moment in offensive positions near the net, thus increasing the probability of being able to win the point.[21] In terms of tactical position, the results show that the conventional formation allows more points to be won compared to the Australian formation. The difference in effectiveness between both tactical situations could be due to two factors. The first one is the direction of the serve, for which Sánchez-Alcaraz *et al.*[26] already indicated that most serves in the conventional formation are made towards the side wall, thus increasing the probability of error,[14, 39] so that by using this tactical arrangement, the server's partner is already closing spaces and gaining a positional advantage. The second factor could be due to the greater distance that the server must travel in Australian formation *versus* conventional,[22, 23] thus needing more time and speed to reach the net and be able to shoot efficiently.[40] Similarly, although the results indicate that serving efficiency is not influenced by the tactical situation according to the type of point, the greatest tendency to lose the point on the serve is when an Australian formation is used at key points. According to Díaz-García *et al.*[41] professional players suffer an increase in mental fatigue and a decrease in reaction time due to the cognitive effort caused by the complex tactical decisions to which they are exposed during matches, so the tension of the match, which increases in this type of points, can cause the effectiveness of the serve to be reduced due to the technical and tactical complexity of this arrangement causing the loss of the point. In relation to the direction of the serve, the results show that players manage to win more points serving to the side wall than serving to the "T," probably because the shots made in the area of the wall, either a sidewall or double-wall stroke have more probability of error or to maintain the advantage in the serve compared to a groundstroke or direct stroke that is usually shot at the "T,"[13, 14] where fewer errors occur.[42] Despite this, the probability of winning the serve to losing it by serving to the "T" is 6.8% higher compared to the side wall, being able to obtain a greater advantage when serving. The second shot after the opponent's return shows

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that there are no significant differences in relation to efficiency, despite this, the results show that the volley is the most performed stroke, coinciding with previous studies which show that 70% of serve-returns are flat, especially in men's padel and when the return is directed towards the server.[20, 43] The backhand volley is the predominant stroke in both Australian and conventional formation, as it has a 14.6% and 4.8% greater chance of the serving partner losing the point, respectively, so the return partner tries to look for this stroke in the opponents because the backhand volley, along with the groundstrokes, is the technical stroke with which most errors are committed,[27] thus being able to take the initiative of the point. The second most used stroke is the bandeja because, from the point of view of the return partner, making a lob allows them to occupy offensive positions and,[5, 44] therefore, the initiative of the point, from the point of view of the serving partner, the bandeja allows them to continue to hold the net and get the point in this area.[21] With respect to the number of strokes during the point, the results show that there is a relationship between the total number of strokes played and the probability of the serving partner winning the point. Previous studies corroborate the results obtained, indicating that as the number of strokes during the point increases, the probability of the serving partner winning the point decreases.[26, 27, 45] The results indicate that from the 10th shot onwards the advantage on serve disappears, with the return partner gaining more advantage from that shot, so the tactic should be adjusted, extending, or trying to end the point as soon as possible, depending on the interests of the serving or returning partner. The results presented also indicate that there is no winner with the serve, or the serve-return as shown in previous studies.[8, 26] In other racket sports, such as singles tennis, the probability of shotting an ace is low,[46] even so, almost 1 ace per match is achieved,[47] being this probability lower in doubles.[38] In padel, because the rules state that the serve must be below the waist to avoid exerting so much force, together with the smaller size of the court compared to doubles tennis,[3] both the serve and the serve-return have the objective of obtaining a tactical advantage by provoking the opponents' error and not to end the point with either of the two. Finally, the set in which the match is being played becomes important for the serve. Previous studies indicate that as the match progresses, fewer points are won on serve,[25] being the second set where there is greater equality on the scoreboard due to the increase in the number of golden points in this set.[28] The results of this study indicate that in this set is where the serving partner tends to win more points on serve, so that a small error in the serve during this set can lead to the loss of the same due to the high percentage of points won. Similarly, the implementation of the golden point has led to an increase in the number of 3 sets played compared to previous seasons.[26] In this sense, the great distance travelled by professional players during a match due to the Australian position that increases when playing an additional set,[22, 23] together with the greater time of tension and concentration caused by the increased duration of the match,[41] can lead to greater physical and mental fatigue during this set that reduces the effectiveness in the serve causing equality in the scoreboard.

Limitations of the study

Although this is the first study to analyze the effectiveness of the serve by analyzing in detail the different time situations of the match and the tactical components of the serve and the rest, the study has some limitations. Firstly, the place of serve (right or left) has not been considered, which could affect the results, since in the left-hand zone there may be more key moments (40-0, 40-30, 0-40 and 30-40) than on the right-hand side (40-15 and 15-40). Secondly, no attention has been paid to the dominance of the player, differentiating between left-handed and right-handed players, as the effectiveness of the serve can vary according to the strategy and place of the serve. It would be interesting for future research to address these issues, which may provide more information for the analysis of the start of the point in professional padel and its effectiveness. The knowledge provided allows both coaches and players to optimize performance by planning training sessions and competitions that focus on tactical, physical, and psychological improvement in order to face each moment of the match. Also, these dates provide new perspectives on the existing knowledge of the serve in padel providing a better understanding of the effectiveness of the same depending on each tactical parameter, these results allow to create tactics of the game depending on each moment both from the point of view of the serving pair and from the point of view of the serving-return pair to optimize the performance of the competition.

Conclusions

The data from this study allow us to establish a tactical strategy in both the serve and the serve-return depending on each situation analyzed. From a temporal point of view, the results show that there are significant differences in efficiency depending on the set, being the second set more

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affected by winning points generally won by the serving partner, and the third set by equality, with the serving partner tending to lose the point. From a tactical point of view, although the variables analyzed did not show significant differences, the results indicated a higher percentage of points won on serve in the conventional formation than in the Australian one, with a more equality between couples in the key points characterized by the playing of the Australian formation. The predominant direction and the one that wins the most points is towards the side wall. Similarly, both the serve and the serve-return are not strokes seeking to end the point as there are no winners in the first two strokes. Therefore, the serving of these strokes is mostly oriented to seek a tactical advantage from the point of view of the server and receiver since, the fewer strokes there are, the more likely to win the point on the serve, although this effect decreases from the stroke number 10. This is why the majority of the serve-returns are flat, with the return partner looking for the backhand volley as with this stroke the tendency to lose the point is higher than with other strokes followed by the bandeja

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Conflicts of interest
The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Authors' contributions
Iván M. Miguel, Diego Muñoz, and Bernardino Javier S. Alcaraz have given substantial contributions to the study conception and design, to the manuscript drafting and revision for important intellectual content; all authors contributed to the data acquisition, analysis, and interpretation. All authors read and approved the final version of the manuscript.

Acknowledgements
The authors acknowledge all the participants for proofreading activity.

History
Article first published online: October 30, 2023. - Manuscript accepted: August 25, 2023. - Manuscript revised: July 20, 2023. - Manuscript received: June 6, 2023.

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