

Analysis of the smash in men´s and women´s junior padel

Análisis del remate en pádel junior masculino y femenino

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Abstract

The objective of this study was to analyze the types of smashes in men´s and women´s junior padel according to the direction of the ball and its effectiveness, making a comparison between the men´s and women´s gender. To do this, 1175 smashes corresponding to six finals (three men´s and three women´s) of three Spanish junior championships were analyzed, differentiating the smashes analyzed between off the wall smash, tray, topspin smash and flat smash. The results show that junior padel players usually perform trays and topspin shots with a crossed trajectory, while flat smashes usually have a parallel trajectory. The flat smash is the type of smash with which players play the most winners (52%) and the tray with which they commit the most errors (39.2%). In addition, the tray is the type of smash that most encourages the continuity of the point (56.1%). Regarding the differences between genders, the results show that in women´s padel there is a greater use off the wall smash (13.8%) and flat smashes (36.5%), while in men´s padel there is a greater use of topspin smashes (22.6%). These results can serve as a reference for coaches and padel players when designing specific training sessions adapted to the demands of the competition, as well as for improving decision-making and establishing feedback.

Key words: Racquet sports, technical-tactical actions, training categories, performance analysis.

Resumen

El objetivo de este estudio fue analizar los tipos de remate en pádel junior masculino y femenino según la dirección de la pelota y su eficacia, realizando una comparativa entre el género masculino y femenino. Para ello, se analizaron 1175 remates correspondientes a seis finales (tres masculinas y tres femeninas) de tres campeonatos de España junior, diferenciando los remates analizados entre bajada de pared, bandeja, remate liftado y remate plano. Los resultados muestran que los jugadores de pádel en categoría junior suelen realizar bandejas y remates liftados con una trayectoria cruzada, mientras que los remates planos suelen llevar una trayectoria paralela. El remate plano es el tipo de remate con el que los jugadores realizan más winners (52%) y la bandeja con el que realizan más errores (39.2%). Además, la bandeja es el tipo de remate que más fomenta la continuidad del punto (56.1%). En cuanto a las diferencias entre géneros, los resultados muestran que en pádel femenino hay mayor uso de bajadas de pared (13.8%) y remates planos (36.5%), mientras que en pádel masculino hay un mayor uso de remates liftados (22.6%). Estos resultados pueden servir de referencia a entrenadores y jugadores de pádel a la hora de diseñar entrenamientos específicos adaptados a las demandas de la competición, así como para la mejora de toma de decisiones y establecimiento de feedback.

Palabras clave: Deportes de raqueta, acciones técnico-tácticas, categorías de formación, análisis del rendimiento.



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Introduction

Padel is a racket sport that born in Acapulco (Mexico) in 1969 when Enrique Corcuera adapted a tennis court to 20x10m, placing walls on the back and sides so that vegetation would not invade his court (Sánchez-Alcaraz, 2013). Currently, for the development of padel, three fundamental elements have been established: the net, the racket and the ball (Sánchez, 2009), being played by two teams formed by pairs that compete inside a closed court with synthetic glass walls and metal fence. This sport is in the ranking of the 10 most played sports in the world and it is observed that there is an increase in the number of people playing padel, which leads to an improvement in physical activity in the population (Courel-Ibáñez, Sánchez-Alcaraz, García-Benítez et al., 2017). This growth of the sport has been reflected in the number of scientific articles, especially those whose topic of study is the analysis of performance in padel (Sánchez-Alcaraz et al., 2017; Sánchez-Alcaraz, Cánovas-Martínez et al., 2022), which aim to observe, record and analyses the game actions of athletes in real contexts of competition, this information being of great use in the court of training (Hughes & Bartlett, 2002).

One of the most studied parameters in padel refers to the time aspects of the game. Regarding the total duration of the match, the studies analyzed have shown a time slightly longer than 30 minutes per set, so that the total playing time can vary between 60 and 90 minutes approximately, depending on whether two or three sets are played (Torres-Luque et al., 2015). Depending on gender, women players seem to obtain significantly higher values for total playing time (García-Benítez et al., 2016). However, actual playing time has been found to be approximately 30% and 35% of total time (García-Benítez et al., 2016; Torres-Luque et al., 2015), being significantly higher for women (Torres-Luque et al., 2015). On the other hand, the average duration of points in professional padel varies between 10-15 seconds, being significantly longer in women (García-Benítez et al., 2016). On the other hand, studies that have quantified the number of shots in padel show an average of between 8 and 10 shots per point, although the number of shots per second is significantly higher in men, indicating a higher rate of play (Sánchez-Alcaraz, Jiménez et al., 2021).

Padel, being a sport played on a court with enclosures that allow the ball to bounce, means that the number of shots per point made by players is greater than in other racket sports such as tennis or badminton (Sánchez-Muñoz et al., 2020). The types of shots played in padel have traditionally been classified into defensive and offensive shots. Defensive shots include direct ground shots (forehand or backhand) and ground shots after hitting the ball on one or two walls, both forehand and backhand (Sánchez-Alcaraz, Martínez-Gallego et al., 2021). On the other hand, offensive shots include volleys, the tray, the flat, off the wall or the topspin smashes (Courel-Ibáñez et al., 2019).

Several studies have determined that the dominance of offensive shots is decisive in the outcome of a padel match

(Courel-Ibáñez, Sánchez-Alcaraz & Cañas, 2017; Escudero-Tena, Muñoz et al., 2022; Ramón-Llín et al., 2020; Sánchez-Alcaraz, Courel-Ibáñez et al., 2020). These studies show that nearly 80% of the winning points are obtained from the net zone, which is where the offensive shots are hit. In addition, the winning pairs perform more offensive actions in 85% of the points, spend more time in the net zone, hit more cross-court shots and hit fewer ground shots with or without a wall during the match. On the contrary, losing pairs play more trays and fewer smashes or winners, tend to lose more long points and perform fewer attacking actions per point and per match (Courel-Ibáñez, Sánchez-Alcaraz & Cañas, 2017; Escudero-Tena, Sánchez-Alcaraz et al., 2021; Ramón-Llín et al., 2020; Sánchez-Alcaraz, Courel-Ibáñez et al., 2020). However, some of these data may vary depending on the gender of the padel players. Thus, men perform more backhand volleys, flat or topspin smashes and in general more shots close to the net, while women perform more lobs, trays and shots from the middle of the court and baseline (Almonacid et al., 2023; Torres-Luque et al., 2015; Escudero-Tena et al., 2020; Sánchez-Alcaraz, Pérez-Puche et al., 2020; Lupo et al., 2018). Furthermore, while women commit a higher percentage of unforced errors, men play a higher percentage of winners (Fernández de Ossó, 2019). Nevertheless, women are more effective on break points (Escudero-Tena, Courel-Ibáñez et al., 2021; Escudero-Tena, Mancha-Triguero et al., 2022).

On the existing studies of the padel smash, its importance and frequency in the game. In professional padel, it can be indicated that smashes are the most characteristic finishing shots in both men and women padel (Escudero-Tena, Almonacid et al., 2022; Escudero-Tena, Muñoz et al., 2022), with some variant of the smash being the technical-tactical action with which men and women players perform more winning shots.

As far as is known, the studies dedicated to padel competition in adolescent players deal with physical requirements (Sánchez-Alcaraz, 2014) and technical-tactical actions (Andreu et al., 2021). In addition, the technical-tactical actions in training stages (mainly at beginner level) show that the most used shots are those made from the baseline (forehand or backhand). However, there are no studies that have evaluated the characteristics of offensive shots, such as smashes, in players in training categories, despite the fact that they are determinant in the padel outcome. Therefore, the aim of this study was to analyses the types of smashes in junior men and women padel according to the direction of the ball and its effectiveness, making a comparison between the men and women genders.

Methodology

Research design

The design of this research falls under the empirical methodology and more specifically it is a study with a descriptive strategy. Furthermore, it is included in the

observational category, being nomothetic, cross-sectional and multidimensional (Ato et al., 2013).

Sample and variables

A total of 1175 smashes in six finals junior category (three women and three men) from three national level

tournaments played in Spain were analyzed. The sample consisted of 12 men and 12 women aged between 16 and 18 ranked among the top 10 in the national junior padel ranking. Table 1 shows the characteristics of the sample of players.

Table 1. Age of participants

	Number	Age ($M \pm S.D.$)
Total sample	24	17.52 \pm 0.51
Male	12	17.33 \pm 0.49
Female	12	17.66 \pm 0.49

M = mean; S.D. = standard deviation

The variables analyzed were as follows:

- Gender: men and women categories were analyzed.
- Types of smashes: following the classification proposed by Sánchez-Alcaraz, Pérez-Puche et al. (2020), the following were defined:
 - Flat smash: an offensive shot, without bounce, which is played over the player's head and on the dominant side. In the execution of this shot, the player hits the ball with a lot of power at the highest possible point, with a flat shot (without effect), so that after bouncing on the opposite side, the ball can go out of the court or return after bouncing against the wall.
 - Topspin smash: an offensive shot, without bouncing, hit from behind the head. The player hits the ball with maximum power with a topspin effect, accelerating the shot by arching the back so that, after bouncing the ball on the opponent's wall, it goes over the side walls.
 - Tray: an offensive shot, without bouncing, which is hit over the player's head and dominant side. In this shot, before hitting the ball, the player opens the face of the racket pointing upwards and hits with a slice effect. The point of impact on the ball is lower than in other smashes. This category also includes the viper, a shot very similar to the tray.
 - Off the wall smash: an offensive shot, with a bounce, which is played over the head and on the player's dominant side. This shot is played when the player, after receiving a lob, lets the ball bounce on the court and bounce on the wall before hitting it. This shot can be hit with flat or slice effect.
- Ball direction: a distinction was made between down the line and cross-court shots.
- Effectiveness of the smash: following the classification made by Ramón-Llin et al. (2020) a distinction was made between continuity, winner and error.

Procedure

"The matches analyzed are broadcast via streaming and later hosted on YouTube, from where they were downloaded for observation, data collection and analysis." The matches were analyzed using the specialized software LINCE (Soto-Fernández et al., 2021), designing an ad-hoc instrument to analyse the variables under study. The data were analyzed by means of systematic observation, carried out by two students of the Sports Science Degree, both specialized in padel and trained for this task. At the end of the training process, each observer analyzed the same matches with the aim of calculating the inter-observer reliability through the Multirater Kappa Free (Randolph, 2005), obtaining values above .80. To ensure data consistency, intra-observer reliability was assessed at the end of the observation process, obtaining minimum values of .80. The kappa values obtained allowed us to consider the degree of agreement as very high (> .80) (Altman, 1991). The ethical provisions of the WMA Declaration of Helsinki (2013) were followed.

Statistical analysis

A descriptive analysis was carried out to obtain information on the number of times the categories of each variable in the study occurred (frequency and percentage). An inferential analysis was then carried out using contingency tables, including the Chi-square statistical test (χ^2) in order to obtain the association between variables. The strength of association between variables was calculated using Cramer's V coefficient (Vc) (Field, 2019). Crewson (2006) differentiates the strength of association according to the value, considering a small (< .100), low (.100-.299), moderate (.300-.499) or high (> .500) association. In addition, subsequent Z-tests were performed to compare column proportions, adjusting for p-values < .05 according to Bonferroni. Contingency tables allowed identification of associations between variable categories through corrected typed residuals (CSR) (Field, 2019). A significance level of $p < .05$ was established and statistical analysis was performed using the SPSS 27.0 statistical package for Windows.

Results

Table 2 shows the differences in the direction of the ball according to the type of padel smash. The results indicate that there are significant differences in the direction of the

ball according to the type of smash ($\chi^2 = 376.826$; $df = 3$; $p < .001$; $V_c = .000$). Significantly more trays and cross-court topspin smash were observed, while there were more down the line flat smash.

Table 2. Differences in the direction of the ball according to the type of the padel smash in junior category (frequency, percentage and corrected standard residuals)

Type of smash	Down the line			Cross-court			Sig.
	N	%	CSR	N	%	CSR	
Tray	146	25.0 a	-13	370	62.7b	13	< .001
Off the wall	60	10.0a	-1.1	72	12.2a	1.1	
Flat	330	56.4a	19.1	30	5.1b	-19.1	
Topspin	49	8.4a	-5.7	118	20.0b	5.7	

CSR = corrected typed residuals; a, b = indicate significant differences in the Z-tests for comparison of column proportions at $p < .05$ adjusted according to Bonferroni

Table 3 shows the differences between the type of smash performed by the players according to their efficiency. The results indicate that there are significant differences in the type of smash according to its efficiency ($\chi^2 = 209.438$; $df = 6$; $p < .001$; $V_c = .000$). The flat (CSR = 9.4) and topspin (CSR

= 7.1) are the types of smashes with which junior players make more winners, while the tray is the gesture with which more errors are committed (CSR = 3.1). In addition, the tray is the type of smash that most promotes the continuity of the point (CSR = 11.6).

Table 3. Differences between the efficacy of the smash according to its type in junior category (frequency, percentage and corrected standard residuals)

Type of smash	Winner			Error			Continuity			Sig.
	N	%	CSR	N	%	CSR	N	%	CSR	
Tray	45	14.7a	-12	38	39.2b	-1	433	56.1c	11.6	< .001
Off the wall	21	6.9a	-2.8	20	20.6b	3.1	91	11.8a	0.8	
Flat	159	52.0a	9.4	33	34.0b	0.8	168	21.8c	-9.1	
Topspin	81	26.5a	7.1	6	6.2b	-2.4	80	10.4b	-5.2	

CSR = corrected typed residuals; a, b = indicate significant differences in the Z-tests for comparison of column proportions at $p < .05$ adjusted according to Bonferroni

Table 4 below shows the results obtained in the types of smashes as a function of sex. There are significant differences in the types of smashes according to sex ($\chi^2 = 78.298$; $df = 3$; $p < .001$; $V_c = .258$). In general, trays are the most common type of smash for both women (44.1%)

and men (43.8%). However, in women's padel there is a significantly higher percentage of off the wall (13.8%) and flat (36.5%) smashes than in men's padel, while in men's padel there is a significantly higher percentage of topspin smash (22.6%) than in women's padel.

Table 4. Differences in the type of the smash used in junior men's and women's padel (frequency, percentage and corrected standard residuals)

Type of smash	Female			Male			Sig.
	N	%	CSR	N	%	CSR	
Tray	256	44.1a	0.1	260	43.8a	-0.1	< .001
Off the wall	80	13.8a	2.7	52	8.8b	-2.7	
Flat	212	36.5a	4.3	148	24.9b	-4.3	
Topspin	33	5.7a	-8.3	134	22.6b	8.3	

CSR = corrected typed residuals; a, b = indicate significant differences in the Z-tests for comparison of column proportions at $p < .05$ adjusted according to Bonferroni

Table 5 shows the results of the types of smashes and their direction in both men's and women's padel. Significant differences are observed in the direction (cross-court or down the line) used by both sexes in the off the wall ($\chi^2 = 4.066$; $df = 1$; $p < .05$; $Vc = .044$) and in the flat ($\chi^2 = 8.078$;

$df = 1$; $p < .05$; $Vc = .004$) smashes. The results show that both girls and boys hit more trays and cross-court topspin smash and more down the line flat smash. However, girls hit significantly more down the line off the wall smash (52.5%), while boys hit more cross-court off the wall smash (65.4%).

Table 5. Frequency, percentage and corrected standard residuals of the direction of the different types of smashes in men's and women's padel

Type of smash	Direction	Women			Men			Sig.
		N	%	CSR	N	%	CSR	
Tray	Down the line	65	25.4a	-1.5	81	31.2a	1.5	.146
	Cross-court	191	74.6a	1.5	179	68.8a	-1.5	
Off the wall	Down the line	42	52.5a	2	18	34.6b	-2	.044
	Cross-court	38	47.5a	-2	34	65.4b	2	
Flat	Down the line	187	88.2a	-2.8	143	96.6b	2.8	.004
	Cross-court	25	11.8a	2.8	5	3.4b	-2.8	
Topspin	Down the line	6	18.2a	-1.6	43	32.1a	1.6	.116
	Cross-court	27	81.8a	1.6	91	67.9a	-1.6	

CSR = corrected typed residuals; a, b = indicate significant differences in the Z-tests for comparison of column proportions at $p < .05$ adjusted according to Bonferroni

Table 6 shows the results of the type of smash and its effectiveness in both men's and women's padel. Significant differences exist in the tray ($\chi^2 = 8.131$; $df = 2$; $p < .05$; $Vc = .017$), in the off the wall ($\chi^2 = 7.449$; $df = 2$; $p < .05$; $Vc = .024$) and in the flat ($\chi^2 = 26.437$; $df = 2$; $p < .001$; $Vc = .000$) smashes according to the effectiveness of it in junior men's and women's padel. The data show that both the tray (men (88.5%) and women (79.3%) padel) and the off

the wall smash (men (80.8%) and women (61.3%) padel) promote continuity in the game, as well as the flat smash in men padel (62.8%) and the topspin smash in women padel (54.5%). Meanwhile, the flat smash is usually a winner in women's padel (53.3%) and the topspin smash in men's padel is usually a winner (50.7%) and in fewer cases continuity (46.3%).

Table 6. Frequency, percentage and corrected standard residuals of the effectiveness of the different types of smashes in men's and women's padel

Type of smash	Effectiveness	Women			Men			Sig.
		N	%	CSR	N	%	CSR	
Tray	Winner	28	10.9a	1.8	17	6.5a	-1.8	.017
	Error	25	9.8a	2.1	13	5.0b	-2.1	
	Continuity	203	79.3a	-2.8	230	88.5b	2.8	
Off the wall	Winner	18	22.5a	2.6	3	5.8b	-2.6	.024
	Error	13	16.3a	0.4	7	13.5a	-0.4	
	Continuity	49	61.3a	-2.4	42	80.8b	2.4	
Flat	Winner	113	53.3a	4.2	46	31.1b	-4.2	< .001
	Error	24	11.3a	1.7	9	6.1a	-1.7	
	Continuity	75	35.4a	-5.1	93	62.8b	5.1	
Topspin	Winner	13	39.4a	-1.2	68	50.7a	1.2	.411
	Error	2	6.1a	0.9	4	3.0a	-0.9	
	Continuity	18	54.5a	0.9	62	46.3a	-0.9	

CSR = corrected typed residuals; a, b = indicate significant differences in the Z-tests for comparison of column proportions at $p < .05$ adjusted according to Bonferroni

Discussion

The aim of this study was to analyse the types of smashes in junior men and women padel according to the direction of the ball and their efficiency, making a comparison between the men and women genders. As observed in previous studies in professional padel, maintaining positions close to the net allows for higher levels of efficiency and winning points, with volleys and smashes being the predominant shots (Ramón-Llin et al., 2021; Torres-Luque et al., 2015). From a defensive point of view, the use of the lob is the most used technical gesture with the aim of making a change of position and being able to reach the net (Escudero-Tena et al., 2020; Muñoz et al., 2017), so the correct use of the smashes prevents opponents from being able to get to the net, as this is where there is the greatest possibility of winning the point (Courel-Ibáñez et al., 2019).

The results obtained in this study show that the tray is the most used smash in both genders, exceeding 43% of the cases, being slightly higher in women's padel. These data are similar to previous studies that analyzed the game of men and women players in the professional category, as their results also indicate that women players play more trays (Sánchez-Alcaraz, Pérez-Puche, et al., 2020), which may be due to the greater use of the lob by women players (Muñoz et al., 2017). On the other hand, flat and topspin smashes are also widely used by junior players. These results agree with the work of Sánchez-Alcaraz, Pérez-Puche, et al. (2020), since the aim of these two smashes is to end the point with a powerful shot. This is why, since in this smash the ball must be hit as high as possible to obtain greater speed in the shot, men use it more than women, possibly due to anthropometric differences in height and physical condition (Sánchez-Muñoz et al., 2020). On the other hand, the off the wall smash is the shot that is least used, as both genders try to return the opponents' lob without bouncing to prevent the opposing partner from getting to the net. In this case, women are more likely to use this type of smash, probably due to a tactical component, as they prefer to let the ball bounce in order to hit it in better conditions.

The direction of the ball in offensive shots such as smashes are an important aspect in order to gain an advantage or win the point. As can be seen, the cross-court direction is the predominant one in the majority of junior padel smashes. Previous studies indicate that there are 20% more cross-court shots than down the line shots in the net zone (Ramón-Llin et al., 2021), as directing the ball towards the side of the court causes it to bounce off the fence, side wall or corner of the back wall and side wall (Courel-Ibáñez et al., 2019), increasing the difficulty in returning it and producing a higher number of errors (Sánchez-Alcaraz, Ferrer-Real, et al., 2021). It also means that players in baseline positions have to be more aware of covering the corner areas than those in the center of the court (Courel-Ibáñez et al., 2019). Likewise, cross-court

hitting allows for a greater angle and a larger surface area on the court to direct the ball, reducing the error rate. In addition, in the case of trays, it allows the ball to travel further, and this, together with the bounce on the side wall or double wall, allows the player who has hit the shot more time to recover the net. However, the data from this study also showed a high percentage of down the line trays. The aim of this type of shot may be to move the baseline players out of their positions in order to open up space to later define the point. Finally, the flat smash is the only shot that is more often hit with a down the line trajectory than a cross-court shot, and this is due to the fact that the main objective of this shot is to return the ball to the court of the player who has hit it without it being able to be returned by the opponents. However, in the female gender there is a high percentage of flat smash cross-court, so it seems that the girls are looking for the ball to leave the court over the side wall with this option (Sánchez-Alcaraz, Pérez-Puche, et al., 2020).

With respect to the effectiveness of the shot, previous studies show that the tray represents, in almost 90% of cases, the continuity of the point in professional players (Sánchez-Alcaraz, Pérez-Puche, et al., 2020). The results of this study have shown that the tray is the smash with the highest percentage of continuity, although it also involves a high percentage of errors in the junior category compared to professional padel. These differences may be due to errors due to the lower technical and tactical level of young players. However, it was observed that junior women players hit more winners with the tray than men players, data that agree with the study by Sánchez-Alcaraz, Jiménez et al. (2022) in professional padel. On the other hand, the flat smash is the smash with which more winners are produced in junior padel, especially in girls. However, previous studies in professional players show that male players achieve a higher number of winners with this shot than women players (Sánchez-Alcaraz, Jiménez et al., 2022). However, boys perform a significantly higher percentage of topspin smash winners than girls, data similar to the study by Sánchez-Alcaraz, Pérez-Puche, et al. (2020), which states that these differences are due to the fact that men players, due to their greater height, obtain a greater angle to perform this type of shot effectively. Finally, another very interesting result is the higher percentage of winning off the wall smash in women's padel compared to men's, which confirms the differences in playing styles and the need to train this type of shot in women's padel to enhance a greater chance of winning the point.

Practical applications

The results of this study can help coaches to carry out an optimal planning of their junior padel players. In addition, they serve as a reference in the design and development of training sessions and tasks, taking into account the different types of the most characteristic smashes, their effectiveness and the direction that the ball should take

depending on the gender of the players. In addition, these results will help in tactical training through better decision making by the players in matches and the application of feedbacks by the coach.

Limitations of the study and future perspectives

This study has certain limitations that must be taken into account when interpreting its results. Only six finals have been analyzed (three men's and three women's) from three junior Spanish national championships, so other rounds of the tournament have not been analyzed. On the other hand, this work has only analyzed the smash shots, so future works could study other important shots such as bouncing shots or volleys in junior category (Sánchez-Alcaraz, Courel-Ibáñez, et al., 2020). Finally, this study has not been carried out using a validated tool, through a group of experts, such as, for example, the one designed by Escudero-Tena et al. (2023) about the smash in padel.

Conclusions

Following the results obtained in this study, the following conclusions can be drawn:

- The tray is the most used smash by junior men and women players. The least used smash in the case of men players is the off the wall smash and in the case of women players the topspin smash.
- The directions of all types of smashes are mostly cross-court, except for flat smash in both sexes, where the trajectory is down the line.
- The tray is the smash that most encourages continuity of play in both genders, although is also the smash with which most errors are made. On the other hand, the flat smash is the type of smash with which most winners are obtained by women players and the topspin smash is the smash with which most winners are obtained by men players.

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