Skill-level differences in final shot characteristics in padel: comparative insights from amateurs and professionals

Diferencias en las características del golpeo final en pádel según el nivel de habilidad: análisis comparativo entre amateurs y profesionales

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Abstract

Objective: this study aimed to analyze the differences between amateur and professional padel players in terms of the type of last shot, its effectiveness and, the court area where it is performed, in both men's and women's padel.
Methodology: a total of 180 matches and 2,278 points were systematically observed.
Results: amateur players committed more unforced errors than professionals (CSR=2.9–4.7), while professionals produced more winners (CSR=2.0–4.0), and more forced errors in men's professional players (CSR=3.2). A relationship was found between the last shot type and player level for winners and unforced errors in men's padel (p<.05). Amateurs scored more winners with the forehand and bandeja, while professionals were more successful with the slow smash. Amateurs made more forced errors with the recovery smash and more unforced errors with the powerful smash, whereas professionals committed more unforced errors with the contrapared and double wall. In women's padel, the relationship was significant for winners (p<.001), with amateurs scoring more with forehand, backhand, back wall forehand and slow smash, and professionals with x3, fake, and powerful smashes. Professional women also committed more forced errors with the forehand, while amateurs committed more unforced errors with the slow and recovery smash. In men's padel, amateurs produced more winners in zone 5 and more forced errors outside the court, while in women's padel, amateurs made more unforced errors in zone 5 and fewer in zone 2, with professionals committing more forced errors in zone 6.
Conclusions: these findings highlight how skill level impacts shot selection and performance.

Keywords

Racquet sports; performance analysis; shot effectiveness; sex.

Resumen

Objetivo: este estudio analiza las diferencias en el tipo de golpe final, la zona de la pista y la efectividad entre jugadores de pádel amateurs y profesionales, masculinos y femeninos.
Metodología: se observaron 180 partidos y 2.270 puntos de forma sistemática.
Resultados: los amateurs cometieron más errores no forzados (CSR=2,9-4,7), mientras que los profesionales lograron más golpes ganadores (CSR=2,0-4,0) y más errores forzados en los hombres profesionales (CSR=3,2). Se hallaron relaciones entre el tipo de golpe final y el nivel de habilidad en los golpes ganadores y errores no forzados en el pádel masculino (p<,05). Los amateurs lograron más golpes ganadores con la derecha y la bandeja, mientras que los profesionales usaron el smash lento. Los amateurs cometieron más errores forzados con el smash de recuperación y errores no forzados con el smash de potencia, mientras que los profesionales cometieron errores no forzados con la contrapared y la doble pared. En el pádel femenino, las amateurs lograron más winners con derecha, revés, pared de fondo y smash lento, mientras que las profesionales destacaron en el smash x3, amago y smash potente (p<,001). Los errores no forzados de las amateurs fueron mayores en zona 5, y en zona 6 para las profesionales.
Conclusiones: estos hallazgos resaltan la influencia del nivel de habilidad en la selección de golpes y el rendimiento.

Palabras clave

Deportes de raqueta; análisis del rendimiento; efectividad del golpe; sexo.

Introduction

Research on padel has predominantly focused on technical-tactical performance at the professional level (Conde-Ripoll, Sánchez-Alcaraz et al., 2024; Escudero-Tena et al., 2024; Martín-Miguel et al., 2024; Romero et al., 2024). In contrast, the performance dynamics of amateur padel players have received limited attention (Ramón-Llín et al., 2021; Sánchez-Alcaraz, Martínez-Gallego, et al., 2021), despite the fact that the majority of coaches work with this group of players. Notably, only one study to date has compared performance parameters between these two levels, indicating that rally duration and the number of shots are greater in elite padel compared to amateur play (Fernández de Ossó et al., 2024).

The effectiveness of the last shot, a key technical-tactical performance indicator (Sánchez-Pay et al., 2021) has been thoroughly investigated (Conde-Ripoll, Muñoz, Sánchez-Alcaraz, et al., 2024). A point can conclude with a winner, a forced error, or an unforced error (Sánchez-Alcaraz, Jiménez, et al., 2021). However, several studies have not made a distinction between forced and unforced errors (Conde-Ripoll, Muñoz, Escudero-Tena, et al., 2024; Escudero-Tena et al., 2022, 2024), while others have considered this categorization (Mellado-Arbelo et al., 2019; Sánchez-Alcaraz, Jiménez, et al., 2021).

In men's professional padel, Sánchez-Alcaraz, Jiménez, et al. (2021) found that winners are more prevalent than unforced errors, with forced errors being the least common method of concluding a point. Conversely, Mellado-Arbelo et al. (2019) revealed that unforced errors are the primary cause of point endings, followed by winners and forced errors. In women's professional padel, unforced errors occur more frequently than winners and forced errors (Sánchez-Alcaraz, Jiménez, et al., 2021). Regarding shot types, winners are typically executed using smashes, bandejas and volleys (forehand and backhand) for both men and women (Escudero-Tena et al., 2024; Escudero-Tena et al., 2024; Escudero-Tena, Parraça, et al., 2023; Sánchez-Alcaraz, Jiménez, et al., 2021). In contrast, errors (without distinguishing between forced and unforced) are commonly made with volleys (forehand and backhand) in men's padel, and with the bandeja in women's padel (Escudero-Tena et al., 2024). Furthermore, Mellado-Arbelo et al. (2019) observed that unforced errors in men's padel are frequently committed with the direct backhand. Regarding the contact point zone, the closer male players are to the net, the higher the percentage of winners produced, with this percentage decreasing as players move further from the net (Courel-Ibáñez et al., 2019).

In amateur padel, to the best of our knowledge, no prior research has examined the effectiveness of the final shot. Therefore, this study aimed to analyze the differences between amateur and professional padel players in terms of the type of last shot, its effectiveness and, the court area where it is performed, in both men's and women's padel. The following hypotheses were proposed: 1) In both men's and women's padel, professional players will produce more winners than amateur players, while amateur players will commit more errors, regardless of the type; 2) in both men's and women's padel, there will be no differences between amateur and professional players regarding the type of shot and the hitting zone.

Method

Research design

The design of this research followed empirical methodology, and, more specifically, a descriptive strategy. In addition, this research falls within an observational category, is nomothetic, punctual, and multidimensional (Thomas et al., 2023).

Sample

The observed matches of the professional category are openly available on the official World Padel Tour (WPT) YouTube channel. The matches belong to semi-final and final rounds. Consequently, the level of the four players of each match is guaranteed to be maximum (top 20 male players (average age = 33.8 years; left-handed n = 2 and right-handed n = 18) and top 20 female players (average age = 30.6 years; left-handed n = 1 and right-handed n = 19) on the WPT circuit).

Amateur matches were randomly selected from competitions hosted by territorial federations. Written consent was obtained from both the federations and the players. Amateur players were considered to

be those players who had not participated in any international category competition, were ranked outside the top 50 regionally, and did not meet the criteria to participate in professional tournaments. A total of 20 male amateur players (average age = 35.2 years; left-handed n = 3 and right-handed n = 17) and 20 female amateur players (average age = 33.4 years; left-handed n = 2 and right-handed n = 18) were included.

In total, 180 games per category were analyzed, with 90 games for each sex, resulting in the examination of 2278 points. Of these, 1182 points were analyzed in the professional category and 1096 in the amateur category.

All procedures were conducted according to the ethical standards in sport and exercise science research (Harriss et al., 2019) and the Ethics Committee of the University of Extremadura (166//2023).

Study variables

The following variables were defined and analyzed based on their categorical core and degree of openness (Anguera & Hernández-Mendo, 2016):

- Sex: men's and women's categories were established to record the possible differences between them.

- Category: professional and amateur categories were established to record the possible differences between them.

- Effectiveness of the last shot: winner, forced error or unforced error. These categories are defined based on previous studies (Sánchez-Alcaraz, Jiménez, et al., 2021).

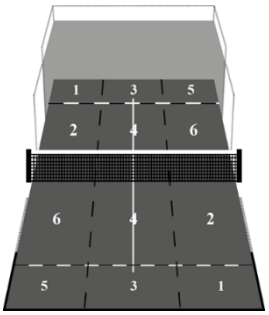
- Last shot type: a difference was made among forehand, backhand, side wall, back wall forehand, back wall backhand, double wall, fence, contrapared, forehand bajada, backhand bajada, forehand volley, backhand volley, dropshot, slow smash, bandeja, vibora, smash x3, smash x4, powerful smash, fake smash, recovery smash and other (Table 1). The definition of each of these categories was based on previous studies (Escudero-Tena et al., 2022, 2024).

Table 1. Last shot type and its definition.

Last shot type	Definition
Forehand	Shot executed after the ball bounces on the body area of the dominant side.
Backhand	Shot executed after the ball bounces on the body area of the non-dominant side.
Side wall	A shot in which the ball, after bouncing on the ground, affects one of the side glasses of the court before being hit.
Back wall forehand	A shot in which the ball, after bouncing on the ground, hits one of the bottom panes of glass before being hit by the dominant side.
Back wall backhand	A shot in which the ball, after bouncing on the ground, hits one of the bottom panes of glass before being hit from the non-dominant side.
Double wall	A shot in which the ball, after bouncing on the ground, affects first on one glass and then on another (side-bottom or bottom-side) before being hit.
Fence	A shot in which the ball, after bouncing on the ground, hits the fence before being hit.
Contrapared	A shot intentionally executed against the back or side glass of one's own court, seeking to redirect the ball into the opponent's court.
Forehand bajada	Offensive shot in which the ball, after bouncing on the ground and bouncing on the glass, is hit with the dominant side at chest height or above.
Backhand bajada	Offensive shot in which the ball, after bouncing on the ground and bouncing on the glass, is hit with the non-dominant side at chest height or above.
Forehand volley	Shot made from the dominant side without a previous bounce.
Backhand volley	Shot made on the non-dominant side without a previous bounce.
Dropshot	A soft shot in which the ball seeks to bounce in the opponent's court near the net.
Slow smash	Aerial shot in which the ball is impacted between 11, 1:30 o'clock, and flat spin.
Bandeja	Aerial shot similar to the forehand volley, with an impact range of 1:30 to 3 o'clock.
Víbora	Aerial shot in which the ball is hit between 2 and 3 o'clock, with high speed and cut/side spin.
Smash x3	Powerful aerial shot where the ball, after bouncing in the opponent's court, bounces on the back glass and leaves the court over the three meters, on the side.
Smash x4	Powerful aerial shot where the ball, after bouncing in the opponent's court, leaves the court over four meters.
Powerful smash	A high-powered aerial shot, typically struck between 11:30 and 1 o'clock, which aims to return the ball to one's own court after bouncing on the ground and bouncing off the back wall of the opponent's court.
Fake smash	Aerial shot, with the same preparation as a power smash or a smash x3, but instead of hitting it with power, before impact the player, seeking to deceive opponents, modifies the gesture so that the ball comes out slowly.
Recovery smash	A smash that is taken after an opponent's power smash. That is, the opposing player makes a smash, the ball bounces on the ground and bounces on the wall(s) of the home field and then the player makes a smash.
Other (cadete, willy…)	Any other shot that has not been defined above as a shot between the legs (Willy) or any other shot not categorized.

- Zone: area of the court where the last shot of each point is made, based on the proposal by Fernández de Osso (2019) (figure 1).

Figure 1. Areas of the court.



Process

A specialist padel observer (with over 10 years of experience on the professional circuit, more than 5 years teaching federation courses, and a PhD in Sports Sciences) collected all the data. An intra-observer reliability analysis was performed to ensure the accuracy of the data collected. The observer reanalyzed a random sample of 30 games to make sure we had enough relevant data representing 10% to 20% of the study sample (Igartua, 2006). The mean intra-observer reliability was 0.96, considered almost perfect (Landis & Koch, 1977). Likewise, another observer, a PhD in Sports Sciences and a padel specialist, with extensive published research on the subject and over five years of experience training padel players, also analyzed a random sample of 30 games to calculate the mean inter-observer reliability, which was 0.94 (Landis & Koch, 1977). Table 2 shows the value of Cohen's Kappa coefficient (K) for each of the study variables.

Table 2. Inter-observer and intra-observer reliability.

Study variables	Inter-observer	Intra-observer
	K	K
Sex	1.00	1.00
Category	1.00	1.00
Effectiveness of the last shot	.98	1.00
Last shot type	.85	.87
Zone	.89	.91

Note: K= Cohen´s kappa coefficient

To minimize potential errors in data interpretation and account for factors like weather conditions or court type, which could influence playing style and performance, only amateur game sequences that occurred under the same conditions as the professional sample were selected for analysis. For this, the same type of court (glass), location (heated indoor court) and ball brand (Head® Padel Pro) were considered.

Data analysis

A descriptive analysis was performed to obtain information on the number of times the categories of each study variable occurred (frequency and percentage). An inferential analysis was continued to develop contingency tables, including the Chi-square ($\chi 2$) statistical test to obtain the association between variables. The strength of association between variables was also calculated, for which Cramer's V coefficient (Vc) was used (Field, 2018). Crewson (2006) differentiates the strength of association according to the value, considering a small (< 0.100), low (0.100 - 0.299), moderate (0.300 - 0.499) or high (> 0.500) 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 standard residuals (CSR). Residuals > |1.96| betrayed cells with more or fewer cases than there should be (Field, 2018). The significance level was set at $p < .05$ and statistical analysis was performed using the SPSS 27.0 statistical package for Windows.

Results

There is a relationship between the effectiveness of the last shot and the category in men's padel ($X^2 = 24.022$; df = 2; $p < .001$; V = 0.154) and women's padel ($X^2 = 15.932$; df = 2; $p < .001$; V = 0.130) (Table 3).

Table 3. Winners, forced errors and unforced errors according to the category in male and female padel.

Effectiveness of the last shot	Male					
	Amateur			Professional		
	n	%	CSR	n	%	CSR
Winners	175	35.4a	-2.0	217	41.5b	2.0
Forced errors	87	17.6a	-3.2	136	26.0b	3.2
Unforced errors	232	47.0a	4.7	170	32.5b	-4.7
Effectiveness of the last shot	Female					
	Amateur			Professional		
	n	%	CSR	n	%	CSR
Winners	109	25.6a	-4.0	198	37.8b	4.0
Forced errors	89	21.0a	1.0	96	18.3a	-1.0
Unforced errors	227	53.4a	2.9	230	43.9b	-2.9

Note: n = number; % = percentage; CSR = corrected standard residuals; CSR > 1.96 = Bold; a, b = indicate significant differences in the Z tests for comparison of column proportions from p < .05 adjusted according to Bonferroni.

In both men's and women's padel, amateur players tend to commit more unforced errors than professional players, while professional players produce more winners compared to amateur players. Furthermore, in men's padel, professional players tend to commit more forced errors than amateur players.

There is a relationship between the type of last shot and the category when the last shot is a winner (X^2 = 32.811; df = 19; p = .025; V = 0.289) and an unforced error (X^2 = 42.090; df = 19; p = .002; V = 0.324) in male padel. However, there is not a relationship between the type of last shot and the category when the last shot is a forced error (X^2 = 21.424; df = 16; p = .163; V = 0.310) in male padel (table 4).

Table 4. Differences between amateurs and professionals according to the last shot type and its effectiveness in male padel.

Last shot type	Winners						Forced errors						Unforced errors					
	Amateur			Professional			Amateur			Professional			Amateur			Professional		
	N	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR
Forehand	11	6.3a	2.0	5	2.3b	-2.0	8	9.2a	-0.6	16	11.8a	0.6	28	12.1a	1.0	15	8.8a	-1.0
Backhand	5	2.9a	1.4	2	0.9a	-1.4	13	14.9a	0.5	17	12.5a	-0.5	34	14.7a	0.7	21	12.4a	-0.7
Side wall							4	4.6a	1.0	3	2.2a	-1.0	3	1.3a	-0.4	3	1.8a	0.4
Back wall forehand	2	1.1a	1.6	0	0.0a	-1.6	4	4.6a	-1.8	16	11.8a	1.8	16	6.9a	0.9	8	4.7a	-0.9
Back wall backhand	3	1.7a	1.2	1	0.5a	-1.2	6	6.9a	-0.5	12	8.8a	0.5	10	4.3a	0.7	5	2.9a	-0.7
Double wall	1	0.6a	0.2	1	0.5a	-0.2	10	11.5a	0.8	11	8.1a	-0.8	5	2.2a	-2.2	11	6.5b	2.2
Fence							0	0.0a	-1.1	2	1.5a	1.1	1	0.4a	-1.3	3	1.8a	1.3
Contrapared	0	0.0a	-1.6	3	1.4a	1.6	10	11.5a	1.1	10	7.4a	-1.1	2	0.9a	-2.4	8	4.7a	2.4
Forehand bajada	8	4.6a	0.4	8	3.7a	-0.4	1	1.1a	0.3	1	0.7a	-0.3	12	5.2a	-0.6	11	6.5a	0.6
Backhand bajada	1	0.6a	-0.8	3	1.4a	0.8	0	0.0a	-0.8	1	0.7a	0.8	7	3.0a	1.2	2	1.2a	-1.2
Forehand volley	30	17.1a	1.5	26	12.0a	-1.5	15	17.2a	1.2	16	11.8a	-1.2	32	13.8a	0.2	22	12.9a	-0.2
Backhand volley	8	4.6a	-0.8	14	6.5a	0.8	7	8.0a	-1.9	23	16.9a	1.9	32	13.8a	-1.1	30	17.6a	1.1
Dropshot	5	2.9a	-0.7	9	4.1a	0.7	0	0.0a	-1.1	2	1.5a	1.1	2	0.9a	-1.6	5	2.9a	1.6
Slow smash	2	1.1a	-2.8	15	6.9b	2.8	0	0.0a	-1.1	2	1.5a	1.1	4	1.7a	-1.1	6	3.5a	1.1
Bandeja	13	7.4a	2.4	5	2.3b	-2.4							12	5.2a	-0.8	12	7.1a	0.8
Vibora	2	1.1a	-0.2	3	1.4a	0.2							0	0.0a	-2.0	3	1.8b	2.0
Smash X3	8	4.6a	-1.5	18	8.3a	1.5							0	0.0a	-1.2	1	0.6a	1.2
Smash X4	9	5.1a	0.0	11	5.1a	0.0												
Powerful smash	56	32.0a	-0.2	71	32.7a	0.2	1	1.1a	1.3	0	0.0a	-1.3	26	11.2a	3.6	3	1.8b	-3.6
Fake smash	2	1.1a	-0.9	5	2.3a	0.9												
Recovery smash	7	4.0a	-1.1	14	6.5a	1.1	6	6.9a	2.1	2	1.5a	-2.1	4	1.7a	1.0	1	0.6a	-1.0
Other	2	1.1a	-0.2	3	1.4a	0.2	2	2.3a	0.5	2	1.5a	-0.5	2	0.9a	1.2	0	0.0a	-1.2

Note: n = number; % = percentage; CSR = corrected standard residuals; CSR > 1.96 = Bold; a, b = indicate significant differences in the Z tests for comparison of column proportions from p < .05 adjusted according to Bonferroni.

In men's padel, amateur players produce more winners with the forehand and bandeja than professional players, while professional players produce more winners with the slow smash. Additionally, amateur players commit more forced errors with the recovery smash and more unforced errors with the powerful smash, while professional players commit more unforced errors with the contrapared and double wall.

There is a relationship between the type of last shot and the category when the last shot is a winner (X^2 = 55.658; df = 19; p < .001; V = 0.426) in female padel. However, there is not a relationship between the type of last shot and the category when the last shot is a forced error (X^2 = 18.646; df = 12; p = .097; V = 0.317) and an unforced error (X^2 = 22.218; df = 18; p = .222; V = 0.220) in female padel (table 5).

Table 5. Differences between amateurs and professionals according to the last shot type and its effectiveness in female padel.

Last shot type	Winners						Forced errors						Unforced errors					
	Amateur			Professional			Amateur			Professional			Amateur			Professional		
	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR
Forehand	12	11.0a	2.4	8	4.0b	-2.4	14	15.7a	-2.6	31	32.3b	2.6	27	11.9a	0.6	23	10.0a	-0.6
Backhand	10	9.2a	2.9	4	2.0a	-2.9	13	14.6a	0.6	11	11.5a	-0.6	27	11.9a	-0.9	34	14.8a	0.9
Side wall							2	2.2a	0.1	2	2.1a	-0.1	5	2.2a	0.7	3	1.3a	-0.7
Back wall forehand	6	5.5b	2.8	1	0.5a	-2.8	10	11.2a	1.2	6	6.3a	-1.2	13	5.7a	0.2	12	5.2a	-0.2
Back wall backhand	2	1.8a	1.9	0	0.0a	-1.9	9	10.1a	1.9	3	3.1a	-1.9	6	2.6a	-1.0	10	4.3a	1.0
Double wall	0	0.0a	-0.7	1	0.5a	0.7	12	13.5a	-0.8	17	17.7b	0.8	4	1.8a	-1.6	10	4.3a	1.6
Fence							3	3.4a	0.1	3	3.1a	-0.1	3	1.3a	1.0	1	0.4a	-1.0
Contrapared	0	0.0a	-0.7	1	0.5a	0.7	5	5.6a	0.8	3	3.1a	-0.8	2	0.9a	-0.4	3	1.3b	0.4
Forehand bajada	7	6.4a	0.9	8	4.0a	-0.9	2	2.2a	1.5	0	0.0a	-1.5	14	6.2a	0.9	10	4.3a	-0.9
Backhand bajada	1	0.9a	-0.4	3	1.5a	0.4							3	1.3a	0.0	3	1.3a	0.0
Forehand volley	11	10.1a	-0.1	21	10.6a	0.1	7	7.9a	0.7	5	5.2a	-0.7	32	14.1a	-0.7	38	16.5a	0.7
Backhand volley	11	10.1a	0.0	20	10.1a	0.0	8	9.0a	-0.8	12	12.5a	0.8	27	11.9a	-0.8	33	14.3a	0.8
Dropshot	4	3.7a	0.3	6	3.0a	-0.3							2	0.9a	0.6	1	0.4a	-0.6
Slow smash	17	15.6b	2.4	14	7.1a	-2.4							26	11.5b	2.4	12	5.2b	-2.4
Bandeja	8	7.3a	0.6	11	5.6a	-0.6							21	9.3a	-1.0	28	12.2a	1.0
Vibora	0	0.0a	-1.5	44	2.0a	1.5							0	0.0a	-1.4	2	0.9a	1.4
Smash X3	0	0.0b	-3.0	16	8.1a	3.0												
Smash X4	1	0.9a	-1.2	6	3.0a	1.2							1	0.4a	1.0	0	0.0a	-1.0
Powerful smash	17	15.6b	-2.8	60	30.3a	2.8							10	4.4b	0.8	7	3.0a	-0.8
Fake smash	0	0.0a	-2.1	8	4.0a	2.1												
Recovery smash	2	1.8a	-0.4	5	2.5a	0.4	4	4.5a	1.4	1	1.0a	-1.4	4	1.8a	2.0	0	0.0a	-2.0
Other	0	0.0a	-0.7	1	0.5a	0.7	0	0.0a	-1.4	2	2.1a	1.4						

Note: n = number; % = percentage; CSR = corrected standard residuals; CSR > 1.96 = Bold; a, b = indicate significant differences in the Z tests for comparison of column proportions from p < .05 adjusted according to Bonferroni.

In women's padel, amateur players produce more winners with the forehand, backhand, back wall forehand, slow smash than professional players, while professional players produce more winners with the smash x3, powerful smash and fake smash. Additionally, professional players commit more forced errors with the forehand, while amateur players commit more unforced errors with the slow smash and recovery smash.

There is not a relationship between the zone and the category when the last shot is a winner (X^2 = 11.072; df = 6; p = .086; V = 0.168), a forced error (X^2 = 7.116; df = 6; p = .417; V = 0.179) and an unforced error (X^2 = 3.407; df = 6; p = .756; V = 0.092) in male padel (table 6).

Table 6. Differences between amateurs and professionals according to the zone and the effectiveness of the last shot in male padel.

Zone	Winners						Forced errors						Unforced errors					
	Amateur			Professional			Amateur			Professional			Amateur			Professional		
	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR
1	16	9.1a	-0.8	25	11.5a	0.8	4	4.6a	-0.6	9	6.6a	0.6	17	7.3a	-1.1	18	10.6a	1.1
2	43	24.6a	1.1	43	19.8a	-1.1	19	21.8a	0.8	24	17.6a	-0.8	47	20.3a	0.4	32	18.8a	-0.4
3	40	22.9a	-1.7	66	30.4a	1.7	25	28.7a	0.1	38	27.9a	-0.1	68	29.3a	0.9	43	25.3a	0.1
4	40	22.9a	0.3	47	21.7a	-0.3	23	26.4a	0.0	36	26.5a	0.0	43	18.5a	0.1	31	18.2a	0.0
5	16	9.1a	2.5	7	3.2a	-2.5	6	6.9a	-0.7	13	9.6a	0.7	27	11.6a	-0.4	22	12.9a	-0.7
6	15	8.6a	0.3	17	7.8a	-0.3	7	8.0a	-0.7	15	11.0a	0.7	30	12.9a	-0.2	23	13.5a	-0.7
Out court	5	2.9a	-1.3	12	5.5a	1.3	3	3.4a	2.2	0	0.0b	-2.2	0	0.0a	-1.2	1	0.6a	1.2

Note: n = number; % = percentage; CSR = corrected standard residuals; CSR > 1.96 = Bold; a, b = indicate significant differences in the Z tests for comparison of column proportions from p < .05 adjusted according to Bonferroni.

In men's padel, amateur players make more winners in zone 5 and commit more forced errors outside the court than professional players.

There is a relationship between the zone and the category when the last shot is an unforced error (X^2 = 22.757; df = 6; p = .001; V = 0.223) in female padel. However, there is not a relationship between the zone and the category when the last shot is a winner (X^2 = 6.941; df = 6; p = .326; V = 0.150) and a forced error (X^2 = 5.226; df = 5; p = .389; V = 0.168) in female padel (table 7).

Table 7. Differences between amateurs and professionals according to the zone and the effectiveness of the last shot in female padel.

Zone	Winners						Forced errors						Unforced errors					
	Amateur			Professional			Amateur			Professional			Amateur			Professional		
	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR	n	%	CSR
1	9	8.3a	-0.9	23	11.6a	0.9	12	13.5a	0.0	13	13.5a	0.0	26	11.5a	-0.9	33	14.3a	0.9
2	25	22.9a	-0.1	46	23.2a	0.1	18	20.2a	0.8	15	15.6a	-0.8	28	12.3a	-2.2	46	20.0b	2.2
3	22	20.2a	0.3	37	18.7a	-0.3	20	22.5a	0.1	21	21.9a	-0.1	42	18.5a	-1.4	55	23.9a	1.4
4	29	26.6a	1.6	37	18.7a	-1.6	21	23.6a	-0.1	23	24.0a	0.1	52	22.9a	0.2	51	22.2a	-0.2
5	17	15.6a	0.2	29	14.6a	-0.2	11	12.4a	1.2	7	7.3a	-1.2	49	21.6a	4.2	18	7.8b	-4.2
6	6	5.5a	-0.8	16	8.1a	0.8	7	7.9a	-2.0	17	17.7b	2.0	29	12.8a	0.8	24	10.4a	-0.8
Out court	1	0.9a	-1.9	10	5.1a	1.9							1	0.4a	-1.0	3	1.3a	1.0

Note: n = number; % = percentage; CSR = corrected standard residuals; CSR > 1.96 = Bold; a, b = indicate significant differences in the Z tests for comparison of column proportions from p < .05 adjusted according to Bonferroni.

In women's padel, amateur players commit more unforced errors in zone 5 and commit fewer unforced errors in zone 2 compared to professional players.

Discussion

The aim of this study was to analyze the differences between amateur and professional padel players in terms of the type of last shot, its effectiveness and the court area where it is performed, in both men's and women's padel.

As an initial hypothesis, it was established that in both women's and men's padel, professional players would produce more winners than amateur players, while the latter will commit more errors, regardless of the type. This hypothesis was almost fully accepted. The results indicate a higher percentage of winners and forced errors in male professional padel, and more winners in female professional than amateur padel players. Previous studies have observed that high-level padel players play more points per match, hit more shots per point, and their matches last longer compared to low-level players (Sánchez-Alcaraz, 2014b, 2014a). High-level players also exhibit greater shot (Sánchez-Alcaraz et al., 2016) leading to fewer unforced errors. Additionally, Ramón-Llín et al. (2017) reported a higher number of strokes per second and greater movement speed in higher-level players. In contrast, Sánchez-Alcaraz (2014a) observed that, in amateur players, points typically last less than 10 seconds, possibly due to a higher number of errors, which aligns with the data obtained in this study. Moreover, the technical and tactical level of amateur players reduces the likelihood of finishing points with winners, with points more often ending in errors. This has been noted by Ramón-Llín et al. (2017), who observed a greater tendency for higher-level players to play closer to the net and use shots after the wall more frequently. Other authors have also found that 65% of points in amateur padel end in unforced errors (Ungureanu et al., 2022).

Another hypothesis was that there would be no differences between amateur and professional players in terms of shot type and hitting zone in both men's and women's padel. This hypothesis was partially accepted. The results indicate that amateur players achieve winners using techniques rarely seen at a high level (such as forehand and bandeja), while they commit more errors using smashes compared to professional players. Recently, Pozo-Ayerbe et al. (2024) observed that professional players achieve winners primarily through net play, such as powerful smashes or volleys, a finding confirmed by previous studies (Escudero-Tena et al., 2024). In professional padel, more than 80% of points are won from positions close to the net (Courel-Ibáñez et al., 2015; Sánchez-Alcaraz et al., 2022), whereas in amateur padel, winning shots such as forehands are more common. This could suggest that, at the amateur level, reaching the net may not be as critical for success as it is at the professional level (Escudero-Tena, Gómez-Ruano, et al., 2023). Similar results can be observed in the women's category, where baseline shots (forehand and backhand) show a higher frequency of winners. Additionally, when comparing the zones where players achieve the most winners, it is noted that amateur players are more likely than expected to score from baseline positions and commit more errors in off-court situations compared to professional players, likely due to differences in skill level.

In the women's category, professional players commit more unforced errors near the net, particularly in volley situations. This is likely due to the increased intensity of shots and greater risk taken to create opportunities for winning points, as noted by other authors (Conde-Ripoll, Martín-Miguel, et al., 2024). These authors also report a higher number of forced errors from shots off one bounce, indicating that

player skill level may influence the location and effectiveness of each type of shot. Lower-level players tend to make more errors than expected in zones further from the net. In amateur padel, players often struggle to gain and maintain control of the net, spending more time in baseline positions, which results in both winning shots and errors occurring predominantly in these areas.

Limitations and future studies

This study has some limitations that should be considered when interpreting the findings. The experience of amateur padel players could be an important contextual variable, as it may affect the effectiveness and type of shot used to finish the point. Additionally, it would be valuable to examine the number of shots per point and its relationship with the last shot. Previous studies have observed that male padel players perform more winners in short-duration points, while female players perform more errors in medium-duration points (Martin-Miguel et al., 2023). Finally, the effectiveness and type of shot should be linked to the result of the set. This relationship is well-known in professional padel but less understood in amateur. Future research should consider these factors to gain a more comprehensive understanding of the playing styles of both amateur and professional padel players.

Conclusions

In conclusion, the technical and tactical actions used to finish points differ between professional and amateur padel. Amateur padel is characterized by a higher number of unforced errors in both genders, while professional padel is marked by a greater number of winners in both genders. Additionally, professional male players commit more forced errors.

The relationship between the final shot of the point and the level of play in men's padel reveals the following: i) amateur players achieve more winners with the forehand and bandeja, while professionals do so with the slow smash; ii) forced errors from the recovery smash are more common among amateur players; and iii) unforced errors with the double wall and contrapared occur more frequently in professional players, while powerful smash errors are more common in amateurs. In women's padel, this relationship indicates: i) more winners with the forehand, backhand, back wall forehand, and slow smash in amateur padel, while professional players achieve more winners with the x3 smash, powerful smash, and fake smash; ii) more forced errors with the forehand among professional players; and iii) more unforced errors among amateurs with the slow smash and recovery smash.

In terms of court zones, the results show that in men's padel: i) amateur players achieve more winners in zone 5, and ii) forced errors are more common outside the court in amateur play. In women's padel: i) professional players commit more forced errors in zone 6, and ii) amateur players commit more unforced errors in zone 5.

The observed differences can be attributed to three key factors. First, tactical positioning issues among amateur players, where pairs fail to close spaces effectively, lead to a higher number of winners from the baseline, particularly in women's padel. Second, technical limitations hinder the proper execution of complex shots like the x3 and x4 smashes, causing players to opt for alternative winners through different shots like the bandeja. When players attempt an inefficient smash, it gives the opposing pair an opportunity to respond with a recovery smash, often resulting in an error due to physical and technical limitations. Finally, the combination of technical and tactical factors contributes to the higher number of unforced errors in amateur padel, arising from poor shot execution and incorrect decision-making related to shot selection, speed, and direction.

Practical applications

This could influence training sessions by guiding them towards specific actions depending on the characteristics of the players. For instance, amateur padel training can be approached from technical, tactical, and physical perspectives. Technically, these players should focus on more complex strokes, such as the smash, to gain a greater advantage in the game. Tactically, improving court positioning to close

spaces will help reduce the high number of winners from the baseline. Additionally, making sound decisions about which stroke to use, as well as its speed and direction, is essential at this level to reduce errors, particularly unforced ones. Physically, proper conditioning to ensure players can perform optimally during specific strokes, such as smash recovery, could help minimize both forced and unforced errors.

On the other hand, in professional padel, tactical training should focus on improving play anticipation to reduce forced errors, particularly in men's padel. Technically, players should work on baseline consistency to avoid unforced errors, such as those with the double wall, as well as forced errors with the forehand. They should also focus on using resources like the wall rebound to enhance their competitive level. Lastly, in women's padel, combined technical-tactical work at the net will help players increase their advantage by reducing both forced and unforced errors.

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