

Article

Analysis of Errors and Winners in Men's and Women's Professional Padel

Adrián Escudero-Tena ¹, Diego Muñoz ², Bernardino Javier Sánchez-Alcaraz ³, Javier García-Rubio ¹
and Sergio J. Ibáñez ^{1,*}

¹ Training Optimization and Sport Performance Research Group (GOERD), Sport Science Faculty, University of Extremadura, 10005 Cáceres, Spain

² Department of Musical, Plastic and Corporal Expression, Faculty of Sport Sciences, University of Extremadura, 10003 Cáceres, Spain

³ Department of Physical Activity and Sport, Faculty of Sport Sciences, University of Murcia, 30700 Murcia, Spain

* Correspondence: sibanez@unex.es

Abstract: The objective was to analyze the effectiveness in men's and women's professional padel of errors and winners depending on the type of shot and the importance of the situation during each game. In addition, differences between men and women were identified. The sample was made up of 2759 points corresponding to the games that finished with a golden point from matches played in the 2021 season of the World Padel Tour circuit. The results show men and women make more errors (men: 58.7%; women: 63.2%) than winners (men: 41.3%; women: 36.8%), and this difference increases as the importance of the points increases in men's padel; however, the opposite happens in women's padel. Trays and smashes are the most characteristic last shots in men's and women's padel (hits with which more winners are achieved), followed by back wall shots (shots where more errors are made) and then drive and backhand volleys. In men's padel there are more winning shots and fewer errors than in women's padel, except in the golden points, where men make more errors than women. These considerations are of great importance, as they help the players to know the most effective way to finish points according to the situation of the game.

Keywords: racket sports; gender; efficacy; performance; game analysis; notational analysis; golden point



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1. Introduction

Padel is one of the most practiced sports in the world [1], and therefore deserves the attention of researchers. The number of articles that have this sport as a subject of study has increased [2] in recent years. There is special interest in the analysis of performance in professional padel, since several investigations have identified game indicators that increase the efficiency of players [3,4]. In addition, previous studies have determined the differences between winning pairs and losing pairs [5–9]. These studies show that about 80% of the direct points are obtained from the net area. Winning pairs have the ability to score points in exchanges lasting longer than 11 s, to make no mistakes in the first four seconds of the point, and to be more effective on break points. They also perform more attacking actions (close to the net) in 85% of the points, spend more time in net zones, and make more cross shots and fewer groundstrokes with or without using the wall during the game. In contrast, losing pairs make more trays and fewer smashes or winners, tend to lose more points of long duration, and perform fewer attacking actions per point and per match. There is a relationship between earning points and occupying areas close to the net. While the objective of the pair of players in the back zone is to fight for the position at the net, that of the players in the net zone is to fight to maintain it [9].

Studies have also been carried out to identify the differences in the game indicators in padel according to the gender of the participants. Differences have been found in the

temporal structure of the game, observing that the total and real time of the game is longer in women's padel [4,10], as well as the duration of the points [10,11]. In addition, the number of shots per point is also higher in women's padel [10,11]. Information has also been obtained on the difference in the participation of men and women players according to their disposition on the field, with the participation of backhand players being higher in men's padel and the participation of right-hand players being higher in women's padel [12]. In addition, men professional players earn a significantly higher percentage of service points than women professional padel players [13].

Regarding the types of shots, men make more backhand volleys, flat, or topspin smashes and in general more strokes close to the net, while women make more lobs, trays, and strokes from the middle and back of the court [4,11,14,15]. Furthermore, while women make a higher percentage of unforced errors, men make a higher percentage of winners [12]. However, women are more effective at break points [16].

These differences found between men and women in game parameters can be attributed to anthropometric characteristics. Men are taller than women [17], with a higher muscle percentage and with higher values in explosive strength and VO_2 max. [18]. In addition, they show a meso-endomorphic somatotype and have significantly lower triceps, thigh, and leg skinfolds [19]. For their part, women have a significantly higher adipose component and an endo-mesomorphic somatotype [19]. Likewise, they obtained significantly higher scores in agility [18].

Since the 2020 season, the World Padel Tour (the most established professional padel circuit in the world) has incorporated the golden point rule, which consists of playing a point that will decide the game when the score is deuce (40-40). The returning pair chooses the side to which the serve will be made (right or left), and the pair that wins the point will be the one that wins the game. Some research has analyzed the influence of the golden point on the score and the temporal structure of the game [20] or its relationship with performance in professional men and women padel players [21]. It concluded that there was a significant increase in the number of breaks, thus increasing the number of games per set, although slightly decreasing its duration. They indicate that the golden point is a performance factor in padel, since the winning pairs manage to earn more golden points than the losers. Additionally, compared to the men's category, in the women's category, a higher percentage of games finish with golden points.

Analysis of the scientific literature confirms the existence of various investigations focused on identifying the differences that occur between the pairs that win and lose, as well as the differences that exist between men's and women's professional padel. However, it is necessary to further this knowledge, studying more thoroughly the effectiveness of men and women padel players (as well as the difference between the two) in the last shot of each point, specifying the type of shot (smash, volley, lob, etc.), and taking into account aspects such as the importance of the point in each game, since it is this last action that determines the success of the point. For all these reasons, the objective of this research was to analyze the effectiveness of professional padel players and learn about the differences between them, depending on the type of shot and the importance of the point during each game.

2. Materials and Methods

2.1. Design of Research

The design of this research follows empirical methodology, and more specifically, a descriptive strategy. In addition, it is included within the observational category, being nomothetic, longitudinal or monitoring and multidimensional [22].

2.2. Sample

The games that finished with a gold point were identified from the matches in the quarterfinals, semifinals, and finals corresponding to six World Padel Tour tournaments in the 2021 season, three Open tournaments (Las Rozas, Málaga, and Sardegna), and three Master tournaments (Valladolid, Cascais, and Barcelona) (Supplementary Materials Tables

S1 and S2). The database was made from the recording of various variables collected from 2765 points from 395 identified games, of which six points were eliminated for various reasons (e.g., points that are not seen). Finally, the sample was made up of 2759 points (1432 men's points and 1327 women's points).

2.3. Study Variables

To carry out this study, the following variables were defined (based on their categorical nucleus and degree of openness [23]) and analyzed:

- Gender: differentiated between men's and women's padel.
- Situation of the scoreboard: the analysis of the scoreboard was carried out distinguishing between: non-key moment (those points that do not imply changes in the set scoreboard, such as at 15-0, 30-0, or 30-15), key moment (points in which a couple has the option to win a game, such as 40-0, 40-15, etc.), and golden points (a decisive point that is disputed with a score of deuce).
- Type of shot: the shots were classified by taking into account the distribution in various previous investigations in [4,6,12,24,25]: straight forehand shot without wall, straight backhand shot without wall, forehand volley, backhand volley, tray or smash, back wall shot, forehand lob, backhand lob, and counter-wall.
- Efficiency of the last shot: differentiated between winning strokes and errors.

2.4. Procedure

The analyzed matches were broadcast through streaming and later hosted on the World Padel Tour website, from where they were downloaded for data observation, collection, and analysis. The specialized software LINCE [26] was used for this process of recording and collecting data, and an ad hoc instrument was designed to analyze the variables under study. The data were analyzed through systematic observation, carried out by a researcher specialized in padel and trained for this task. At the end of the training process, an intra-observer reliability analysis was performed to ensure the accuracy of the data collected. The observer analyzed a sample of 420 points (60 games) to guarantee a relevant amount of data, between 10–20% of the study sample [27]. Thus, the mean reliability of the analysis test was 0.98, considered almost perfect [28].

2.5. Statistical 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 conducted to develop contingency tables, including the Chi-square (χ^2) statistical test in order to obtain the association between variables. The strength of association between the variables was also calculated, for which Cramer's V coefficient (V_c) was used [29]. Crewson differentiates the strength of the association based on the value, considering a small (<0.100), low (0.100 – 0.299), moderate (0.300 – 0.499), or high (>0.500) association [30]. In addition, the contingency tables made it possible to identify the associations between the categories of the variables through the corrected standardized residuals (CSR), considering values from 1.96 to 2.58 as small; 2.58 to 3.29 as medium, and more than 3.29 as strong [29]. Concerning the variables of type of stroke and effectiveness of the stroke, subsequent Z tests were carried out to compare column proportions, adjusting the values of $p < 0.05$ according to Bonferroni.

3. Results

The results show that gender is associated with the effectiveness of the last shot of the points ($\chi^2(1) = 18.574$; $p = 0.000$; $V_c = 0.082$) and the type of shot ($\chi^2(8) = 17.477$; $p = 0.026$; $V_c = 0.080$).

Table 1 shows the frequency, percentage, and corrected typified residuals of the effectiveness of the last shot of the points in men's and women's professional padel and

its relationship with the type of shot and the importance of the situation in each game according to the score.

Table 1. Errors and winning strokes in men's and women's professional padel and their relationship with the type of stroke and the game situation according to the scoreboard.

	Men											
	Non-Key Moment				Key Moment				Golden Point			
	Winners		Errors		Winners		Errors		Winners		Errors	
	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR
Type of shot	44.2		55.8		41.0		59.0		38.5		61.5	
Straight forehand without wall	2.0a	−2.9	5.9b	2.9	0.8a	−2.2	5.4b	2.2	0.0a	−2.3	6.3b	2.3
Straight backhand without wall	1.2a	−4.6	7.9b	4.6	0.0a	−2.9	6.5b	2.9	0.0a	−2.4	7.1b	2.4
Forehand volley	13.6	−1.1	16.4	1.1	16.4	0.2	15.8	−0.2	11.4	−1.0	16.7	1.0
Backhand volley	7.7a	−5.3	20.3b	5.3	9.4a	−2.3	19.0b	2.3	10.1a	−2.1	21.4b	2.1
Tray/Smash	55.2a	13.9	12.6b	−13.9	59.4a	8.3	14.7b	−8.3	63.3a	7.5	12.7b	−7.5
Back wall shot	20.0	−1.5	24.2	1.5	13.3	−1.9	21.7	1.9	13.9	−1.2	20.6	1.2
Forehand lob	0.2a	−3.4	3.5b	3.4	0.0a	−3.3	8.2b	3.3	1.3	−1.9	7.1	1.9
Backhand lob	0.0a	−4.6	5.2b	4.6	0.8	−1.7	3.8	1.7	0.0	−1.8	4.0	1.8
Counter-wall	0.0a	−4.1	4.1b	4.1	0.0a	−2.5	4.9b	2.5	0.0	−1.8	4.0	1.8
Women												
	Non-Key Moment				Key Moment				Golden Point			
	Winners		Errors		Winners		Errors		Winners		Errors	
	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR
	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR
Type of shot	32.5		67.5		37.2		62.8		40.6		59.4	
Straight forehand without wall	1.5a	−3.1	6.3b	3.1	6.3	−0.6	8.0	0.6	1.3a	−2.2	9.0b	2.2
Straight backhand without wall	2.2a	−3.1	7.6b	3.1	0.9a	−2.7	8.0b	2.7	2.6	−0.9	5.5	0.9
Forehand volley	19.8	1.9	14.6	−1.9	20.7	1.3	15.0	−1.3	25.0	1.2	18.0	−1.2
Backhand volley	11.7a	−2.4	18.4b	2.4	13.5	−1.3	19.3	1.3	11.8	−1.2	18.9	1.2
Tray/Smash	53.1a	11.1	16.3b	−11.1	37.8a	5.1	12.8b	−5.1	53.9a	5.4	17.1b	−5.4
Back wall shot	11.7a	−4.5	25.2b	4.5	19.8	−1.5	27.3	1.5	5.3a	−3.5	24.2b	3.5
Forehand lob	0.0a	−3.9	5.3b	3.9	0.9a	−2.1	5.9b	2.1	0.0	−1.7	3.7	1.7
Backhand lob	0.0a	−3.4	4.0b	3.4	0.0	−1.9	3.2	1.9	0.0	−1.2	1.9	1.2
Counter-wall	0.0a	−2.5	2.3b	2.5	0.0	−0.8	0.5	0.8	0.0	−1.2	1.9	1.2

a, b = indicate significant differences in the Z tests for comparison of column proportions from $p < 0.05$ adjusted according to Bonferroni. CSR = corrected standardized residuals.

Professional men padel players make more mistakes than winners in all the game situations studied. In addition, the percentage of winning shots decreases as the importance of the points increases during each game; however, the percentage of errors increases (non-key moment; key moment; golden point).

The most frequent last shot in men's padel is a tray or smash (36.3%), followed by back wall shots (19.0%), then forehand volleys (15.1%), and then backhand volleys (14.7%).

Trays and smashes are the most effective shots made by men regardless of the game situation (CSR = 13.9; CSR = 8.3; CSR = 7.5). However, men make more errors than winners when it comes to a straight forehand without wall, straight backhand without wall, or backhand volley regardless of the game situation. They make more errors than winners when they hit a forehand lob or counter-wall when the game situation is a non-key or key moment, and they make more errors than winners when they hit a backhand lob during non-key moments.

On the other hand, although professional women padel players make more errors than winning shots, the difference between percentages decreases as the importance of the points increases, thus the difference in golden points is less than at key moments and this, in turn, is less than at non-key moments.

The last most characteristic shot in women's padel is the tray or smash (31.8%), followed by back wall shots (19.0%), then forehand volleys (18.8%), and then backhand volleys (15.6%).

The most effective shots made by women regardless of the game situation are trays and smashes (CSR = 11.1; CSR = 5.1; CSR = 5.4). However, during golden points, they make

more mistakes than winners when they hit straight forehands without wall or shots off the wall. Similarly, during key moments, they make more mistakes than winners when they hit tight backhands or forehand lobs. Finally, during non-key moments, players make more errors than winners in all shot types analyzed, except for forehand volleys and trays or smashes.

Moreover, the results show that the effectiveness of the last shot of the points is associated with gender ($\chi^2(1) = 18.574$; $p = 0.000$; $V_c = 0.082$) and the type of shot ($\chi^2(8) = 602.893$; $p = 0.000$; $V_c = 0.467$).

Table 2 presents the frequency, percentage, and corrected typified residuals in men's and women's professional padel according to their relationship with the type of shot and the game situation based on the score in winning shots and errors.

Table 2. Men's padel, women's padel, and their relationship according to the type of shot and the game situation in winning shots and errors.

	Winners											
	Non-Key Moment				Key Moment				Golden Point			
	Men		Women		Men		Women		Men		Women	
	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR
Type of shot	59.7		40.3		53.6		46.4		51.0		49.0	
Straight forehand without wall	2.0	0.5	1.5	−0.5	0.8a	−2.4	6.3b	2.4	0.0	−1.0	1.3	1.0
Straight backhand without wall	1.2	−1.0	2.2	1.0	0.0	−1.1	0.9	1.1	0.0	−1.5	2.6	1.5
Forehand volley	13.6a	−2.1	19.8b	2.1	16.4	−0.9	20.7	0.9	11.4a	−2.2	25.0b	2.2
Backhand volley	7.7	−1.8	11.7	1.8	9.4	−1.0	13.5	1.0	10.1	−0.3	11.8	0.3
Tray/Smash	55.2	0.5	53.1	−0.5	59.4a	3.3	37.8b	−3.3	63.3	1.2	53.9	−1.2
Back wall shot	20.0a	2.9	11.7b	−2.9	13.3	−1.4	19.8	1.4	13.9	1.8	5.3	−1.8
Forehand lob	0.2	0.8	0.0	−0.8	0.0	−1.1	0.9	1.1	1.3	1.0	0.0	−1.0
Backhand lob	0.0	0.0	0.0	0.0	0.8	0.9	0.0	−0.9	0.0	0.0	0.0	0.0
Counter-wall	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Errors												
	Non-Key Moment				Key Moment				Golden Point			
	Men		Women		Men		Women		Men		Women	
	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR
	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR	%	CSR
Type of shot	47.4		52.6		49.6		50.4		53.2		46.8	
Straight forehand without wall	5.9	−0.3	6.3	0.3	5.4	−1.0	8.0	1.0	6.3	−0.8	9.0	0.8
Straight backhand without wall	7.9	0.1	7.6	−0.1	6.5	−0.6	8.0	0.6	7.1	0.6	5.5	−0.6
Forehand volley	16.4	0.8	14.6	−0.8	15.8	0.2	15.0	−0.2	16.7	−0.2	18.0	0.2
Backhand volley	20.3	0.8	18.4	−0.8	19.0	−0.1	19.3	0.1	21.4	0.5	18.9	−0.5
Tray/Smash	12.6	−1.8	16.3	1.8	14.7	0.5	12.8	−0.5	12.7	−0.9	17.1	0.9
Back wall shot	24.2	−0.4	25.2	0.4	21.7	−1.3	27.3	1.3	20.6	−0.6	24.2	0.6
Forehand lob	3.5	−1.4	5.3	1.4	8.2	0.9	5.9	−0.9	7.1	1.2	3.7	−1.2
Backhand lob	5.2	0.8	4.0	−0.8	3.8	0.3	3.2	−0.3	4.0	1.0	1.9	−1.0
Counter-wall	4.1	1.7	2.3	−1.7	4.9a	2.6	0.5b	−2.6	4.0	1.0	1.9	−1.0

a, b = indicate significant differences in the Z tests for comparison of column proportions from $p < 0.05$ adjusted according to Bonferroni. CSR = corrected standardized residuals.

In men's padel, more winners are made than in women's padel and therefore more points are earned; however, this difference decreases as the importance of the point increases.

The most characteristic winning shots made by men are trays and smashes, followed by wall shots and forehand and backhand volleys. On the other hand, women use trays and smashes more as winners, followed by forehand volleys, and then wall shots and backhand volleys. When it comes to winners, men hit more off the wall than women at non-key moments. In addition, men execute more trays and smashes and fewer straight forehands without the wall than women at key moments.

In men's padel, fewer errors are made than in women's padel at non-key moments and at key moments and therefore fewer points are lost. However, men make more mistakes than women in golden points.

The most characteristic error made by men and women is when hitting back wall shots, followed by backhand volleys, and then forehand volleys and trays or smashes. When it comes to errors, men hit more against the wall than women at key moments.

4. Discussion

The objective of this research was to analyze the effectiveness of the finishing strokes made by professional padel players and to ascertain the differences between them, taking into account the importance of the situation during each game and the type of stroke.

The results obtained show that both men and women make more errors than winners, which would reinforce one of the main objectives of this sport, which is to minimize the number of errors. Ramón-Llín and collaborators also conclude that professional players make more mistakes than winners, although in their research, they did not make a distinction between men and women [7]. In addition, the results show that the difference between errors and winners increases as the importance of the point increases during each game in men's padel, where in golden points, more than 60% of the points end with an error. However, the opposite happens in women's padel, as this difference decreases, going from almost 70% of errors in non-key moments, to less than 60% of errors in golden points. The importance of the point seems to modify the behavior of the players, making the game more conservative in the men's category, waiting for the rival's mistake, while in women's padel, the percentage of winning shots increases. Likewise, Sánchez-Alcaraz and collaborators state in their study that the importance of the point on the match scoreboard makes players change their game behavior [31]. These findings are very novel, since no previous research in padel has taken into account the importance of the point. Players must pay special attention to the different moments of the game (non-key moment, key moment, or golden point), creating training routines in which specific situations are established, that is, training with scoreboard simulation.

The most characteristic last shot in men's and women's padel is the tray or the smash, followed by the wall shot, and then the forehand volley and then the backhand volley. Another investigation [25], whose topic of study is finishing shots, concludes that volleys (30.8%) are the shots most used by players, followed by smashes (22.7%), wall shots (22.1%), and trays (6.4%). They do not make a distinction between forehand and backhand volleys though. On the other hand, Lupo and collaborators conclude in their study that the most common finishing shots in professional men and women are smashes, followed by shots from the wall [11]. In addition, while the third most characteristic type of shot is the forehand volley and then the backhand volley in men's padel, in women's padel, the third most common shot is the backhand volley and then the forehand volley. Professional players must train these types of shots, finding the most suitable occasion to make them, since they are the most common finishing shots, and therefore the last action that determines success in the point.

The results of this study showed that trays and smashes are the most effective shots made by men and women to score points regardless of the game situation. Several investigations also conclude that winning pairs make a greater number of smashes and winning smashes than losing pairs [5–7,11]. Professional players should use trays and smashes as often as possible, as these are the shots with which men and women players earn the most points and make the fewest mistakes. Coaches must provide information on the effectiveness of this type of hitting to their players and create specific tasks where it is treated as finishing actions. In addition, Sánchez-Alcaraz and collaborators indicate in their study that while men perform more flat and topspin shots, women use the tray more, significantly decreasing its effectiveness when the players move away from the net [15]. These results could be due to anthropometric and strength differences between men and women elite players [17,18], as the men are taller, with a greater muscle percentage and higher levels of vertical jump and grip strength than the women players, which would allow them to successfully use the smash in positions further away from the net [15].

Taking into account which are the most characteristic finishing shots and according to the percentage of errors and winning shots made, in men's padel, the least effective type of shot is the backhand volley, while, in women's padel, the type of the least effective shot is the wall shot, followed by the backhand volley. Various studies that analyze the differences between winners and losers in different game contexts (finishing shots, attacking actions, full-point shots) indicate that players who lose make a higher percentage of backhand volleys [6,11] and back wall shots [7,11]. Therefore, professional padel players must train backhand and wall volley shots and try to treat them as continuity shots and not finishing shots, especially in important game situations (key moments or golden points). Coaches should create specific tasks where backhand volleys and wall shots are treated as holding shots and not finishing shots.

More winning shots are made in men's padel than in women's padel; however, this difference decreases as the importance of the point increases. On the other hand, in men's padel, fewer errors are made than in women's padel at non-key and at key moments. However, men make more mistakes than women in golden points. The conclusions of other investigations coincide with the results obtained in this study, since they show that men make more winners and fewer unforced errors than women [12,16]. Likewise, Escudero-Tena and collaborators show that women are more effective in resolving break points [16]. Although men develop a more aggressive game, making more winners and fewer errors, they must be more effective in important points, that is, they must be more conservative in this type of game situation. On the contrary, women, although they play better during important points, should reduce the number of errors to achieve a more attractive and fluid game. Sánchez-Alcaraz and collaborators state in their study that the importance of the point on the match scoreboard makes players increase the rest time between points, and that it may be due to both tactical aspects in the preparation of the point and the need for good physical recovery for the player [31].

The most characteristic winning shots made by men are trays and smashes, followed by wall shots, forehand, and backhand volleys. On the other hand, women use more trays and smashes as winners, followed by forehand volleys, and then wall shots and backhand volleys. In addition, the most characteristic mistake made by men and women is when hitting back wall shots, followed by backhand volleys and then forehand volleys and trays or smashes. This information is of great interest, since it coincides with the results of other investigations [7,11] and helps players to improve decision-making or to develop competitive strategies. Likewise, it provides information on the technical-tactical behavior of the players on the court, thus allowing the design of specific tasks by the coaches.

Despite the novel results found in this study, some of the limitations found should be highlighted, and that will not make it possible in the near future to be able to better determine the effect of the importance of the point in finishing actions in padel. The number of shots per point was not taken into account depending on the moment of play, a fact that could affect the outcome of the point. In addition, bearing in mind the moment of the set (beginning, middle, or end), as well as the equality in the score of the set, and the number of the set, are factors that could influence the results obtained. Future studies could be aimed at trying to determine the influence of these contextual variables on the finishing actions in padel.

5. Conclusions

Both men and women make more mistakes than winners. In addition, this difference increases as the importance of the point in men's padel increases. However, the opposite happens in women's padel, as this difference decreases.

Trays and smashes are the most characteristic final shots in men's and women's padel, followed by back wall shots and forehand and backhand volleys.

The most common winners in men's and women's padel are trays and smashes, while the most characteristic mistakes are when hitting back wall shots and then backhand volleys. In addition, in men's padel, more winning strokes are made than in women's padel.

Thus, men's padel is generally more aggressive, although this difference decreases as the importance of the point increases. Padel players should try to reduce the most common mistakes by training these shots, taking into account the importance of the point.

On the other hand, these results could contribute to knowing how the players should play the most determinant points in the game.

These findings are highly relevant, since the style of play differs according to the gender of the athletes and helps players make the decision to perform one type of finishing shot or another depending on the moment of the game. In addition, it helps coaches design specific training tasks and develop competition strategies.

Supplementary Materials: The following are available online at <https://www.mdpi.com/xxx/s1>, Table S1: Links to each video; Table S2: Analyzed games.

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