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ORIGINAL

DESIGN AND VALIDATION OF AN OBSERVATIONAL INSTRUMENT FOR FINAL ACTIONS IN PADEL

DISEÑO Y VALIDACIÓN DE UN INSTRUMENTO OBSERVACIONAL PARA ACCIONES FINALISTAS EN PÁDEL

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ABSTRACT

During the last years, padel has been one of the fastest growing sports in Spain, reflected in an increase of investigations about it. So, the aim of this study was to design an observation instrument that allows us analyze how points are concluded in padel (IPAAFP). Also, the instrument must be valid and

reliable. A group of padel expert judges ($n=10$) evaluated the Adequacy and Writing of 16 items on an 1-10 scale. Aiken's V coefficient and Cronbach's α were the statistical coefficients used in that process. Neither of the items had to be eliminated ($V=.83$) and the value of internal reliability was $.838$, but we had to make small adjustments in IPAAFP. Finally, we can conclude that the IPAAFP is a valid and reliable instrument for the analysis of the final actions in the padel.

KEY WORDS: Racket sports, Observation, Content Validity, Reliability.

RESUMEN

El pádel es uno de los deportes con mayor crecimiento en España, lo que se ve reflejado en un número cada vez mayor de investigaciones. El objetivo del presente trabajo fue diseñar un instrumento de observación que permita analizar las acciones finalistas en el pádel (IPAAFP) y, además, comprobar su validez y fiabilidad. Un grupo de jueces expertos ($n=10$), evaluaron en una escala 1-10 la Adecuación y Redacción de 17 ítems que componen el instrumento. La validez de contenido fue evaluada con la *V de Aiken* ($V=0,83$) y la congruencia interna con el *α de Cronbach* ($0,838$). Ningún ítem tuvo que ser eliminado, pero sobre la base de las valoraciones cualitativas de los expertos se realizaron modificaciones en la redacción de los ítems. Tras el proceso de validación del instrumento, se puede concluir que el IPAAFP es válido y fiable para el análisis de las acciones finalistas en el pádel.

PALABRAS CLAVE: Deportes de raqueta, Observación, Validez de contenido, Fiabilidad.

1. INTRODUCTION

To carry out scientific works that address padel as a subject of study can be justified from two points of view: the social impact of such sport and the lack of quantity and thematic variety of publications that investigate it (Díaz, García, Grijota, Muñoz & Muñoz, 2015; Sánchez-Alcaraz, Courel-Ibañez & Cañas, 2018). The existing publications on padel are focused in the description of kinematic and psychophysiological variables (Díaz, Grijota, Robles, Maynar & Muñoz, 2017; Carbonell, Ferrándiz & Pascual, 2017). On the contrary, at technical-tactical level, there is no system that provides information and helps players in competition. However, it is scientifically proven the effectiveness of including feedback on the performance of athletes (Anguera, 1990).

Observational techniques, whose scientific character is endorsed (Suen & Ary, 1989; Riba, 1991; Bakeman & Gottman, 1997), raise a great interest among researchers in racquet sports. Thus, there are examples in net sports, such as tennis (Gorospe, Hernández, Anguera & Martínez, 2005) and table tennis (Pradas, Floria, González-Jurado, Carrasco & Bataller, 2012), or net and wall sports, such as squash (Catalán & González, 2015). On the contrary, regarding padel, there is little research that analyses technique and tactics through an

observational tool (Courel-Ibañez & Sánchez-Alcaráz, 2017). It is worth mentioning Fernández de Osso & León (2017), who present a tool to record the frequency of the first/second service, as well as the time markers and the hits used. However, we consider that there is still no instrument that guarantees the analysis of the game in relation to the performance that is taking place, thus being able to help our athletes with a scientific basis even during the game itself, since the rules of play in padel allow the existence of a coach to support players during competition, unlike, for example, tennis. Therefore, this study will proceed to the design of an observation sheet with the above-mentioned characteristics.

The large number of technical-tactical actions as well as speed in the game of racquet sports makes it difficult to analyse the game through observation, so it can be interesting to select performance indicators to observe instead of observing all the game. This aspect is justified from two perspectives. On the one hand, the first perspective lies in the fact that from the technical and effective organisation of high competition training (Hong, Robinson, Chan, Clark & Choi, 1996; Malagoli, Lobietti & Merni, 2010), as well as from the effective transmission of information between the coach and the athlete (Moreno, Santos, Ramos, Sanz, Fuentes & Del Villar, 2002). In padel, these isolated analyses can refer, among others, to the moment of the serve or the final hit, for example. Furthermore, within these isolated analyses, some authors such as Hughes, Hughes & Behan (2007) and Over & O'Donoghue (2010) conclude that there are certain issues that cannot be missing in a category system for racquet sports, such as the resource used, the duration of exchanges, the effectiveness of hits, the number of service and/or whether players are at the serve or the return. The second issue to take into account is that observation is a research field with an extensive scientific trajectory and a defined methodology of the validation and reliability processes of the instruments (Thomas, Silverman & Nelson, 2015), which must be respected.

Based on this, the purpose of this research is the design of an observation instrument that allows to describe and analyse the final actions that complete the padel points (hereinafter IAAFAP), as well as demonstrate the validity and reliability of this instrument.

2. METHOD

According to Ato, López & Benavente (2013), this study was defined within the instrumental methodology, as its aim was to elaborate and validate a new observation instrument to evaluate the actions that finish the point in padel.

2.1. SAMPLE

The sample selected for the study was made up of a group of expert judges who assessed the content of the instrument's items (Rodríguez, Gil & García, 1996). The name of expert judge is subject to the criteria established for the study, and based on the knowledge of the sport in question and the scientific procedure and/or validation (Valles, 2003; Escobar & Cuervo, 2008). Each

judge must meet, at least, 80% of the criteria defined below, i.e. 4 out of 5. i) Hold a PhD degree; ii) Be or have been a university professor; iii) Hold a Level II federal qualification in a racquet sport; iv) A minimum of 10 years of experience as a racquet sport coach; v) Have publications with a racquet sport theme.

15 subjects were identified as meeting the inclusion criteria, of which 10 responded to the questionnaire (66%). Table 1 shows the inclusion criteria met by each of the expert judges.

Table 1. Criteria met by expert judges

Criteria	Expert judges									
	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10
C1	X	X	X	X	X	X	X	X	X	X
C2	X	X	X	X		X	X	X	X	X
C3	X	X		X	X	X	X	X	X	X
C4	X	X	X	X	X	X	X		X	X
C5	X	X	X	X	X	X	X	X	X	X

2.2. Variables

The variables that made up the content of the instrument were defined. Furthermore, the statistical variables were identified for validation (Escobar & Cuervo, 2008). Finally, the instrument included 16 content variables

On the other hand, two variables were taken into account in the validation process of the instrument:

A) Content validity. Obtained through *Aiken's V* statistic (Aiken, 1985), which defines the degree of adequacy of each of the constructs that make up an object of study (Abad, Olea, Ponsoda & García, 2011).

B) Internal consistency. Calculated in the study through *Cronbach's α* (Cronbach, 1990), which measures the degree of correlation between the different items of the same test (Abad et cols., 2011).


The elaboration of the instrument was submitted to the judgment of experts, who had to score on a Likert Scale from 1 to 10 the degrees of Adequacy (relevance to the object of study) and Writing (accuracy and correctness), separately, for each of the defined items. In addition, it was possible to make a subjective assessment of one or more items in the comments section.

In this way, a series of quantitative and qualitative variables were obtained, which later received a mathematical treatment, to be able to develop a valid and reliable observation instrument for the analysis of the final actions in padel.

2.3. INSTRUMENT

Then, the 16 variables of analysis that made up the final instrument were presented based on its categorical core and the different opening ranges (Anguera, 1991):

Variable	Definition/comment	Opening range
1. Pairs	The reference to be used will be the ranking of the competition	1. Highest ranking pair 2. Lowest ranking pair
2. Players		1. Forehand pair 1 2. Backhand pair 1 3. Forehand pair 2 4. Backhand pair 2
3. Laterality	Dominant hand of each player	1. Right-handed players 2. Left-handed players
4. Serve data	Describe whether the point starts with the first or second serve	1. First serve 2. Second serve
5. Status of the server	Describe whether the point starts with the first or second serve	1. Pair at serve 2. Pair at return
6. Partial result of the game		1. 0-0 2. 15-0 3. 0-15 4. 15-15 5. 30-15 6. 15-30 7. 30-30 8. 40-15 9. 15-40 10. 40-30 11. 30-40 12. 40-40 13. A-40 14. 40-A
7. Partial result of the set		1. 0-0 2. 1-0 3. 0-1 4. 1-1 5. 2-1 6. 1-2 7. 2-2 8. 3-2 9. 2-3 10. 3-3 11. 4-3 12. 3-4 13. 4-4 14. 5-4 15. 4-5 16. 5-5 17. 6-5 18. 5-6 19. 6-6 20. + 1 break
8. Partial result of the match		1. 0-0 2. 1-0 3. 0-1 4. 1-1
9. Winner of the match		1. Winner pair 1 2. Winner pair 2
10. Type of hitting used	It refers to the hit that finishes the point	1.- Forehand ground (non-off the back wall) 2.- Backhand ground (non-off the back wall) 3.- Off the back wall forehand

		4.- Off the back wall backhand 5.- Lob 6.- Forehand volley 7.- Backhand volley 8.- <i>Bandeja</i> or tray shot 9.- Smash
11. Finisher hit area	Area from which the player hits the ball that finishes the point	
12. Ball delivery area before finishing	Area from which the opposing player sends the ball to the player who finishes the point	Padel court diagram
13. Finisher hit destination area	Area where the player who finishes the point sends that final who	Padel court diagram
14. Effectiveness	How the point finishes	1. Success. Smash x4 2. Success. Smash x3 3. Success. Double bounce. 4. Success. Body contact. 5. Success. Causing forced error. 6. Success Others. 7. Failure. Direct ball net. 8. Failure. Direct ball side elements or ground. 9.- Failure Other
15. Rally	Number of hits from the exchange prior to the completion of the point	1. Short rally (<8 hits) 2. Intermediate rally (8-16 hits) 3. Long rally (>16 hits)

2.4. DATA ANALYSIS

The Content Validity of the IAAFAP was calculated using the *Aiken's V* coefficient (Aiken, 1985), which is one of the most widespread when it comes to expert group assessments. The value of this coefficient ranges from 0 to 1, where 1 indicates perfect concordance between the judges with respect to the evaluated content. For its calculation, the programme Visual Basic 6.0 was used, which employs the modified formula of Peinfield & Giacobbi (2004):

$$V = \frac{\bar{X} - l}{k}$$

\bar{X} refers to the mean of the scores obtained by the judges, l is the lowest value of the scale (1) and k is its range (10-1=9). The programme provides the values of *Aiken's V* and its confidence intervals at 90, 95 and 99%. The values of 95% were taken into account (Merino y Livia, 2009), recommended for research in social sciences.

Once *Aiken's V* was calculated, the next step was to calculate the critical value of said variable, according to which an item or variable must be eliminated, modified or accepted. Taking into account the characteristics of the sample and the IAAFAP, the "*Large-Sample Test for the Mean of V*" or *central limit theorem for large samples* had to be used:

$$V = \frac{z}{.2\sqrt{3mn(c+1)/(c-1)}} + .5$$

In this formula, Z is the significant value of the content validity ($Z=1.645$ in .95), m is the number of items of the instrument ($m=16$) and n corresponds to the number of expert judges who participated in the data collection ($n=10$), being c the different possibilities of response of the same ($c=10$). According to these calculations, the value for the IAAFAP based on its characteristics is $V=0.83$ to reject the null hypothesis. In other words, all the items found below those values should be discarded for *Aiken's V*. In addition, all the suggestions made by the experts for the modification and improvement of the items of the instrument were taken into account.

Finally, to analyse the internal consistency, Cronbach's α and the statistical programme SPSS 19.0 were used to perform the calculations. Following Field (2009) and Polit & Hungler (2000), the value from which to consider them reliable was set at 0.70.

3. RESULTS

The results obtained in the analysis of the validity and reliability of the IAAFAP are presented below:

Table 2 shows the results of the *Aiken's V* for the Validity of the Adequacy and Writing for each of the categories:

Table 2. Aiken's V values for the IAAFAP Adequacy and Writing

Variable	Adequacy			Writing		
	Mean	Aiken's V	95%	Mean	Aiken's V	95%
Pairs	9.2	0.88	0.8-0.93	9.1	0.88	0.8-0.93
Player	10	1	0.95-1	10	1	0.95-1
Laterality	10	1	0.95-1	10	1	0.95-1
Serve Data	9.4	0.88	0.8-0.93	9.3	0.88	0.8-0.93
Status of the server	10	1	0.95-1	10	1	0.95-1
Partial result of the game	9.4	0.88	0.8-0.93	9.2	0.88	0.8-0.93
Partial result of the set	9.4	0.88	0.8-0.93	9.4	0.88	0.8-0.93
Partial result of the match	10	1	0.95-1	10	1	0.95-1
Winner of the match	10	1	0.95-1	10	1	0.95-1
Type of hitting used	9.1	0.88	0.8-0.93	9.1	0.88	0.8-0.93
Finisher hit area	9.1	0.88	0.8-0.93	9.1	0.88	0.8-0.93
Ball delivery area before finishing	9.1	0.88	0.8-0.93	9.2	0.88	0.8-0.93
Destination area	9.1	0.88	0.8-0.93	9.1	0.88	0.8-0.93
Court diagram	9.2	0.88	0.8-0.93	9.2	0.88	0.8-0.93
Effectiveness	9.1	0.88	0.8-0.93	9.2	0.88	0.8-0.93
Rally	9.9	0.88	0.8-0.93	9.9	0.88	0.8-0.93

As can be seen, all the items exceed the 0.83 that was established as a critical value for *Aiken's V*.

Table 3 provides a summary of the qualitative assessments that the experts made of our instrument.

Table 3. Expert qualitative assessments.

Item	Expert	Comments
14	6	"More areas could be defined"
14	9	"Right, improving it involves difficult observation"
14	2	"In experts, more areas are required"
7	10	"Indicate produced breaks"
7	9	"Breaks"
10	9	"Indicate hitting height"
10	9	"Other ranking possibilities"

Finally, table 4 sets out the values of internal consistency, through Cronbach's α , both the adequacy and writing as well as of the complete instrument.

Table 4. Cronbach's Alpha values for the IAAFAP.

	Adequacy	Writing	Instrument
α	0.73	0.82	0.838
n	16	16	32

In this case, reliability values above 0.70 points were obtained, as established by Field (2009) and Polit & Hungler (2000), for the validation of the instrument.

4. DISCUSSION

The purpose of this study was to elaborate and validate an observation sheet for the analysis of the final hits in padel, with guarantees of validity and reliability.

While the literature of other racquet sports shows that there are multiple applications of the observation instruments in these sports, in padel the interventions that have been made for this line of research are reduced. One of the few examples to be highlighted is the work of Fernández de Osso & León (2017), which record a series of quantitative variables that are not related to the outcome or effectiveness of the decisions of athletes. This work seeks to solve tactical problems in padel, so it can be considered as a pioneer in the sport in question, as it includes an analysis of the Serve Data and the type of hitting as indicators of the sport performance. The IAAFAP is also one of the first research works that seeks to link the observational methodology with padel sport in a specific way. However, unlike the previous one, the IAAFAP has been designed to find the link between the tactical variables defined by the experts and the result of these variables in terms of efficiency values, which in the future may conclude with the definition of performance indicators specific to the padel sport.

Regarding the definition of the variables, Fernández de Osso y León (2017) established the Serve Data and the type of hitting as variables of technical-tactical study, as well as others cited in the bibliography by O'Donoghue & Ingram (2001), O'Donoghue & Liddle (1998) or Johnson & McHugh (2006). These authors concluded that there were a series of relevant study variables in racquet sports. Their analyses demonstrated the relationship with the performance indicators. The work of these researchers was mainly focused on tennis, but some variables such as the rally or the hitting efficacy are applicable to other racquet sports, and were of great help to enrich the instrument presented in this work. In this sense, some works that have not focused on the design of instruments but have researched padel tactics (Muñoz, Sánchez-Alcaraz, Courel, Díaz, Julián & Muñoz, 2017; Courel & Sanchez Alcaraz, 2017) have been of great help in defining the instrument.

Finally, the IAAFAP defines up to 16 performance variables, giving rise to a very complete characterisation of the situation to be analysed, since the opponents are described (player, partner and laterality), the final and partial results are established, and the definition situation is described (hitting, game areas and effectiveness). Specifically, referring to the hitting areas, the elaboration of a padel court diagram is another of the contributions presented in this work. No other study with these characteristics has been found in the consulted bibliography. Although this court diagram could be divided into more parts, especially in the attack zone, the establishment of the lines of the court as a reference is intended to facilitate the work of the observer and to guarantee the reliability of the data that reach the trainer or researcher.

With regard to the elaboration of the categories of the IAAFAP, Fernández de Osso & Leon, (2017), establish two situations of analysis game: the serve and the subsequent game as a whole, counted by all the hits that take place. In other sports, such as volleyball (Moreno et. Cols., 2002) or other racquet sports (Hong et. Cols, 1996), they define that focusing attention in a specific situation of the game can be an effective strategy for observing and transmitting information to the athlete. In this sense, the IAAFAP is not only one of the first instruments to focus exclusively on the sport of padel, it also focuses on a single aspect of the game, in this case one as decisive as the final hit. The IAAFAP can become a help for padel competition and training, and in this sense, the authors mentioned above explain that specialisation is a fundamental characteristic of sports technification.

Subsequently, once the variables of the study had been defined, it was necessary to demonstrate the validity of the observation instrument. Although several methodologies have been defined to record the validity of an instrument of these characteristics, for the present work the *Aiken's V* coefficient has been chosen, which is one of the most used to evaluate groups of experts, which allows to contrast the results with numerous existing bibliography. Aiken (1985), defines a formula, previously exposed, to calculate its coefficient, and also describes that according to the numbers of judges involved and possibilities of response the critical value for the acceptance of the items must vary, in such a way that the greater the size of the sample of the experts the lower are the requirements in this value, since it is understood that consensus is implicit. Cuervo & Escobar (2008) cite in a complementary way that if 80% of the judges agree on a question, it must be approved, but Aiken (1985) details in depth his procedure: any value of the coefficient above the critical value for Aiken's *V* must be accepted, and this value is specific to each study.

In this sense, *Aiken's V* coefficient has been used in other similar works of recent publication. García-Santos & Ibáñez (2016) obtained a critical value of $V=0.69$ in the validation of their instrument on basketball refereeing. Conejero, Claver, Fernández, González & Moreno (2017) obtained a value of $V=0.67$ in a study on decision-making in volleyball, with similarities to the present work in terms of the selection of a specific action of the game to be observed, in this case the catching in volleyball. Furthermore, in this line, García-Martín, Antúnez and Ibáñez (2016) present values of $V=0.70$ in training process work in expert basketball players. As it can be seen, in all these works previously presented the values of *the Aiken's V* exceed 0.70, but none of them is as high as the .83 of the present study, so it is exposed one of the most demanding works of those carried out so far. The high level of demand in the IAAFAP may be due to its number of items, experts and range of response, since as explained above, the divisors of the Aiken formula (1985) depend on all of them. Even so, none of the items of the present work must have been eliminated. Probably, the reason why such high scores were obtained is that there is a global consensus among experts when it comes to knowing the technical and tactical needs of padel. For the necessary modifications of the items, the qualitative assessments of the experts, made in the comments section of the cards provided to them, were taken into account.

Finally, for the reliability of the instrument, the *Cronbach's Alpha* coefficient was used (Cronbach, 1990). The choice of this coefficient was its contrasting use in social science research, which have similar characteristics to this study. This statistic allows obtaining the reliability both for the instrument in its entirety as well as for the Writing and Adequacy separately. Field (2009) and Polit & Hungler (2000), consider that all the values above 0.70 define the instrument as reliable at the internal level. The values obtained from this coefficient in the present study were 0.83. Other works, such as those from González-Espinosa, Feu, García, Antúnez and García-Santos (2017), achieved a higher value of 0.960 for their comparison between different methodologies of basketball teaching. However, in the work on the evaluation of basketball referees by García Santos and Ibáñez (2016), they obtained a lower value, 0.712 in particular. As it can be seen, the present study obtains an intermediate value with respect to the previous works, in the internal consistency, which therefore defines it as a reliable instrument, as it exceeded by far the 0.70 established as a reference by Field (2009) and Polit & Hungler (2000) for this statistic. These values obtained can be explained by the fact that they are a group of experts with very specific ideas about the needs of the sport in question, and are a group of people defined by some international, concrete and deliberate characteristics by the researchers in the work.

5. CONCLUSIONS

The IAAFAP is a new and perfect instrument for analysing padel, which includes up to 16 variables, including a padel court diagram.

The IAAFAP is a valid and proven instrument for evaluating the final actions in padel.

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