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Spike performance in K1: influence of rotation and reception area on high level men's volleyball teams
Rendimiento del remate en K1: Influencia de la rotación y la zona de recepción en equipos de voleibol de alto nivel masculino

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Abstract. The purpose of this study was to investigate the association between the reception zone and the spiking performance in each of the game rotations in top level men's volleyball teams. The sample consisted of 29 men´s matches of final phases in Olympic Games, World League and World Cup between 2012 and 2016, obtaining a sample of 3,689 spikes in the K1 phase. The variables analyzed were: the rotation of the reception team, the reception area and the spike performance. Ordinal regression models were used to determine the influence of the receiving zone and the interaction of rotation on spike performance. The results show significant interaction between the rotation and the reception area on spike performance (X^2_{46} = 127.885; p <.001; r2 = .036), which allow us to understand the greater or lesser probability of achieving a better spike performance in some of the rotations. In conclusion, the performance of the spike varies depending on the interaction of the rotation of the team and the reception area, but this relation in global level, only explain 3.6% of the variance of the spike. The analysis of the situations in which significance has been found could be associated with strategic decisions in the execution of the serve and the training of the K1.
Keywords: Sport performance, side out, rotation, attack, reception zone, serve

Resumen. El objetivo de este estudio, fue investigar la asociación de la zona de recepción con el rendimiento del remate considerando el impacto de la rotación, en equipos de voleibol masculino de alto nivel. Fueron analizados 29 partidos de selecciones internacionales masculinas de máximo nivel, obteniendo una muestra de 3689 remates en la fase de KI. Las variables analizadas fueron: la rotación del equipo en recepción, la zona de recepción y el rendimiento del remate. Se emplearon modelos de regresión ordinales para determinar la influencia de la zona de recepción y la interacción de la rotación en el rendimiento del remate. Los resultados mostraron interacciones significativas entre la rotación y la zona de recepción, que permiten entender la mayor o menor probabilidad de conseguir un mejor rendimiento en remate ($p<0.001$) en algunas de las rotaciones. En conclusión, el rendimiento del remate es diferente en función de la interacción de la rotación del equipo y de la zona de recepción, lo que podría asociarse con decisiones tácticas en la ejecución del saque.
Palabras clave: Rendimiento deportivo, complejo 1, rotación, ataque, zona de recepción, saque

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Introduction

In the past, volleyball performance was associated with the isolated evaluation of the effectiveness of technical actions that have the greatest impact on the game (Hernández et al., 2021; Marcelino et al., 2011). However, analyzing skills individually, ignored the dynamic interactions of which they are part (Lames & McGarry, 2007), and didn´t reveal the in-game sequences and patterns that exist in transition plays. Currently, one of the common research designs in volleyball are analysis that try to be predictive through association studies (Silva et al., 2016), which are used to associate different variables with performance, quantifying their relationship, and seeking a better understanding of the game (Fernandez-Echeverria et al., 2017). For this reason in recent years, studies have been developed the analysis of the different aspects of volleyball, their relationships and chronology, grouping the actions into phases or strategic complexes and applying systemic analysis approaches with the goal of getting a global and deeper understanding of the game, becomes increasingly important (Hernández et al., 2021; Hurst et al., 2016; Martins et al., 2021; Marzano-Felisatti et al., 2022).

Volleyball has a sequential and cyclical nature (Carrero et al., 2017; João & Pires, 2015), with a continuous transition from attack to defense (Beal, 1991). This develops through structured phases in the game called complexes (Molina & Salas, 2009). The delimitation of these complexes has a special relevance in order to identify competitive units that allow predicting player behavior and performance (Costa et al., 2018; Mesquita et al., 2013). Despite the lack of consensus in the categorization of strategic complexes among different authors, the different categorizations agree in pointing to complex 1 (K1), as the game phase that opposes the serve, and is composed of the reception, setting and spike (Hurst et al., 2016).

In national and international men´s competitions, several researches have considered the K1 as the complex that best predicts the success of teams through its effectiveness (Patsiaouras et al., 2009; Ugrinowitsch et al., 2014), reaching success rates close to 65% (García-de-Alcaráz et al., 2020; Sánchez-Moreno et al., 2015), and assuming the spike performance to be the greatest indicator and predictor of K1 performance (Drikos et al., 2021; Marelić et al., 2004). Although the spike is the main predictor of K1 performance, there are studies that show the relevance of the reception and placement pass in the success of the subsequent attack. (Araújo et al., 2020; Bergeles & Nikolaidou, 2011; Costa et al., 2018; González-Silva et al., 2020; João & Pires, 2015). Among the variables related to reception that have received attention from several researches is the reception area. The reception area has

been studied using different topographic maps that have tried to adapt to the functionality of the game. Thus, some of the studies have related the reception area with variables of the serve such as the technique used (Ciuffarella et al., 2013; Kitsiou et al., 2020; Stamm et al., 2016) the area of origin, direction and serve effectiveness (González-Silva et al., 2020; Stamm et al., 2016; Stankovic et al., 2018; Valhondo et al., 2018). Other studies have tried to relate the reception zones with the technical action of reception, or different K1 variables (Callejón & Hernández, 2009; Rentero et al., 2015). That has been attempted by reporting on the frequencies in the reception zones, associating the reception zones with the roles of the receiving players (Lima et al., 2008; Maia & Mesquita, 2006), with the reception technique (Paulo et al., 2016), the setting zone (Afonso et al., 2012; João et al., 2006), the sending zone for the setting (González-Silva et al., 2016), the role of the attacking player (Marcelino et al., 2014), the attack time (Afonso et al., 2010; Rocha et al., 2021), with other elements of the game through a map of interactions with centroids (Hurst et al., 2016; Laporta et al., 2018) or social network análisis (Rocha et al., 2021), the reception performance (Afonso et al., 2017; Carrero et al., 2017; João & Pires, 2015; Maia & Mesquita, 2006; Paulo et al., 2016), the reception performance contextualized with the rotation of the receiving team (López et al., 2022) and the effect of attack (Rocha et al., 2021).

But none of the studies consulted that have related the reception zone with the performance of the K1 attack have reporting a significant association. (Afonso et al., 2010; Hurst et al., 2016; Rocha et al., 2021). That is so despite having found trends in the delivery of the serve to reception zones that seem to indicate a strategic goal that is not directly related to reception performance, but rather with making it difficult for the receivers to join the spike and creating attack combinations (Grgantov et al., 2018; João & Pires, 2015; Kitsiou et al., 2020; López et al., 2022; Maia & Mesquita, 2006; Marcelino et al., 2014; Paulo et al., 2016; Sotiropoulos et al., 2021), facilitating the defense and blocking of the serving team (García-Tormo et al., 2006; Ureña et al., 2000). Based on this, sending the serve to a certain reception zone could have two possible goals: the direct goal of scoring or reducing reception performance, or hindering the development of an attack structure by reducing the performance in the spike. But both strategic goals could be conditioned by the rotation of the receiving team.

The rotation of the receiving team refers to the position of the setter before putting the ball into play at the beginning of each point, according to the six official game positions (Silva, Sattler, et al., 2016), established in section 7.4 of the Official Volleyball Rules (FIVB, 2016). The use of a game system with a single setter by high-level teams leads to the development of six rotations as six different contexts at the beginning of the K1 sequence (López et al., 2022). There are studies that relate the rotation of the receiving team to the effectiveness of the K1 attack. While some of which do not describe a relationship between both variables (Laios & Kountouris, 2011; Palao et al., 2005); Silva, Sattler, et al. (2016) found a strong association of some rotations with winning, but only in lower ranked teams.

Understanding the rotations as different contexts, the main of this study is to identify the relationship between the rotation and the reception area, and its possible interaction with spike performance in the highest international level men's teams. The hypothesis of this research is that spike performance is related to the reception area and the rotation of the team. This relationship varies depending on specific game situations, which enables the detection of interactions between the rotation and the receiving zone that modulate spike performance.

Methods

Methodology

This study has been carried out using observational methodology through a categorical system that meets the requirements of completeness and mutual exclusivity (Anguera & Hernández-Mendo, 2013), allowing the recording of all observed cases. A follow-up observation was carried out by recording the final phases of men's world competitions during an Olympic cycle; with a nomothetic criterion, considering the sample as a plurality of study units; a multidimensional response level, considering several levels of response: contextual, behavioural and evaluative (Anguera et al., 2018).

The making of this study was approved by the Research Commission of the European University of Madrid with reference CIPI / 18/181.

Sample

A total of 3689 actions of spikes side-outs were recorded corresponding to 29 male world-high-performance matches. Sampling used was of convenience and non-probabilistic. Matches were selected according to the following criteria:

1. Be part of the final stages of one of the main international male competitions played in the Olympic Cycle 2012-2016: Olympic Games 2012, World League 2013, 2014, 2015 & 2016, World Championship 2014 and World Cup 2015.
2. Be a match played since quarters to finals.
3. Image quality was at least 720 p or greater.
4. The full match was available online.
5. The perspective of the field was mostly lateral.

Variables

Three variables were analyzed. Each of them was defined by its corresponding system of categories:

- Receiving team rotation (RT) - Six categories were established according to the setter´s position in the moment of serve (Silva, Sattler, et al., 2016).
- Reception zone (RZ) – The topographic map of 8

zones used by López et al. (2022) and adapted from Marcelino et al. (2014), was used. This map features 4 front equally sized zones that are 4 meters deep from the net, and 4 back zones of the same size that are 5 meters deep reaching the bottom of the field. The categories: RZ1, RZ2, RZ43, RZ32, RZ4, RZ5, RZ56 and RZ61 are reflected in Figure 1.

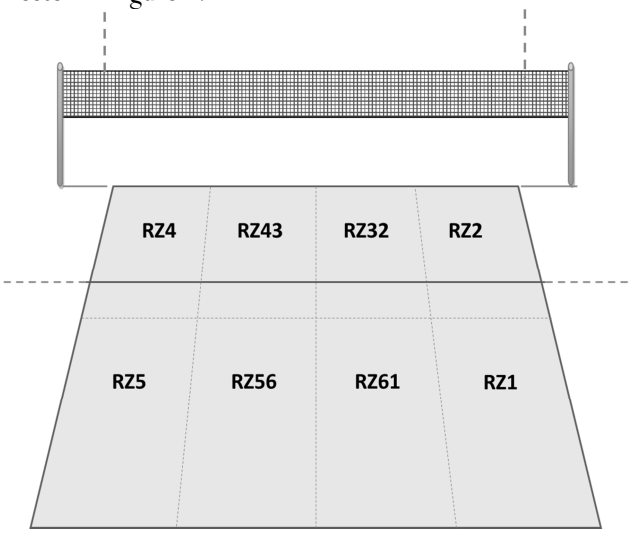

Figure 1. Reception zones. Adapted from Lopez et al. (2022).

- Spike performance (SP). The tip was included as a type of spike. In the attempt of doing a throughout assessing of performance, the Coleman scale was adapted by adding 1 more category and establishing 6 values. (0) Spike Error: The serve achieves an ace or a reception error. (1) Spike Poor: The spike sent to the opposite side is controlled by the defending team, allowing playing any type of setting. (2) Spike Negative: The spike sent to the opposite side is controlled by the defending team, allowing setting first times with risk. (3) Spike Neutral: The spike sent to the opposite side is controlled by the defending team, not allowing a game reconstruction with first times. (4) Spike Positive: The spike is contacted by the opposite team, not managing a spike attack move. (5) Spike Point: The spike sent to the opposite side becomes a point.

Approach and Procedure.

Actions were reviewed by a single and expert observer (with national top-level and international level II coach's certification, experience in performance evaluation and team management). Two months later after finishing the recording of the sample, and in order to confirm intra-observer reliability, several matches were randomly selected to reach 10.49% of the sample actions, which is above the reference value of 10% (Tabachnick & Fidell, 2007). The values achieved with Cohen's Kappa (range: .850 to .976) were higher than .75 (Fleiss et al., 2003).

Later, a second observer with the same qualifications as the first one, analyzed the same sample as the main observer to calculate the inter-observer reliability test (range: .841 to .965) and two months later the intra-observer reliability test (range: .873 to .998). In both cases, Cohen's Kappa values were above .75.

Following the principles of observational methodology, both observers were trained and received specific training (Medina & Delgado, 1999).

For the data recording LINCE 1.3 sport observation and analysis software was used (Gabin et al., 2012).

Data analysis

Frequencies were used to inform descriptive results. To determine the influence of the reception zone on spike performance, 3 ordinal regressions models were elaborated. The first model included bivariate estimations, second model multivariate adjusting model, and third model included the rotation´s interaction analysis. To evaluate the variance experienced by the models, Nagelkerke pseudo r^2 was calculated.

The level of significance was set at $p = .05$ in contrasting all hypothesis, and statistical processing was carried out with IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY (IBM Corp., 2012).

Results

3,689 spike actions were recorded. To assess the relationship between RT, RZ and SP, we proceeded to develop three models based on ordinal regressions.

First, the bivariate relationships between rotation, reception zone and spike performance were evaluated (Model 1, Table 1). In this case, no significant relationship was found between RT and SP ($X^2_5 = .399$; $p = .094$; $r_2 = .003$), nor between RZ and SP ($X^2_7 = 12.626$; $p = .082$; $r_2 = .004$).

Model 2 (Table 1) includes multivariate analysis adjusted with RT and RZ. This model was not significant either ($X^2_{12} = 20.229$; $p = .063$; $r_2 = .006$).

Table 1.
Bi-variate (model 1) and multi-variate adjusted (model 2) ordinal regression models to analyze spike performance based on Team Rotation and Zone Reception

	n	MODEL 1		MODEL 2	
		OR (CI95%)	p	OR (CI95%)	p
RT1	623	-.05 (-.2; .1)	.496	-.06 (-.21; .09)	.428
RT2	558	.12 (-.03; .28)	.124	.1 (-.06; .26)	.221
RT3	563	.05 (-.11; .2)	.539	.06 (-.1; .21)	.466
RT4	584	.08 (-.07; .23)	.304	.05 (-.1; .21)	.495
RT5	637	.16 (0; .31)	.044	.14 (-.02; .29)	.087
RT6	724	Ref.	.	Ref.	.
RZ1	640	-.05 (-.18; .09)	.511	-.03 (-.17; .11)	.672
RZ2	50	.22 (-.21; .65)	.311	.26 (-.17; .69)	.231
RZ4	57	-.09 (-.45; .28)	.645	-.1 (-.46; .26)	.585
RZ5	708	.1 (-.04; .24)	.153	.09 (-.04; .23)	.179
RZ32	31	-.45 (-.89; -.01)	.044	-.45 (-.89; -.02)	.042
RZ43	86	.14 (-.18; .47)	.383	.13 (-.2; .45)	.446
RZ56	1124	.1 (-.02; .22)	.106	.09 (-.04; .21)	.166
RZ61	993	Ref.	.	Ref.	.

Abbreviations: OR: Odds ratio. CI; Confidence Interval. p: p-value.

Finally, Model 3 (Table 2) presents the interactions of RT and RZ in SP. The model was significant ($X^2_{46} = 127.885$; $p < .001$; $r2 = .036$), explaining 3.6% of the variance of the SP. The analysis of Model 3 allows us to interpret that spike performance was superior in the RZ61

of the RT6 compared to the RZ32 of the same rotation and in the RZ5 of the RT2 compared to the RZ61 of the same rotation. In addition, studying the CI95%, higher spike performance was observed in the actions developed in RT2 * RZ5 as compared to RT1 * RZ61, RT2 * RZ61, RT4 * RZ61, RT6 * RZ5, RT6 * RZ32, RT3 * RZ1, RT3 * RZ4, RT5 * RZ56 and RT6 * RZ61. Likewise, spike performance in the actions of RT2 * RZ5, RT4 * RZ5 and RT5 * RZ61 was higher than in the actions of RT6 * RZ32.

Figures 2 and 3 have been prepared to facilitate the understanding of the previous results. The specific roles of the players have been defined based on Silva, Sattler, et al. (2016).

Table 2.
Interaction ordinal regression model (model 3) to analyze spike performance based on interaction between Rotation Team and Reception Zone

		RT1	RT2	RT3	RT4	RT5	RT6
RZ1	n	145	55	143	66	57	174
	OR (CI95%)	-.11 (-.52; .29)	.1 (-.4; .6)	-.17 (-.59; .25)	.13 (-.37; .62)	.05 (-.49; .58)	-.01 (-.29; .27)
	p	.59	.695	.425	.615	.869	.94
RZ2	n	15	1	11	6	0	17
	OR (CI95%)	.31 (-.77; 1.4)	-.33 (-2.86; 2.19)	.05 (-1.12; 1.21)	.54 (-1.01; 2.09)		.08 (-.62; .79)
	p	.57	.795	.935	.496		.814
RZ4	n	3	11	10	14	8	11
	OR (CI95%)	-.65 (-.28; .98)	.43 (-.91; 1.77)	-.99 (-2.15; .18)	-.4 (-1.54; .73)	-.03 (-1.46; 1.41)	.17 (-.72; 1.07)
	p	.434	.529	.096	.487	.973	.705
RZ5	n	115	101	66	149	151	126
	OR (CI95%)	.28 (-.16; .73)	.74 (.26; 1.23)	-.02 (-.52; 0.48)	.43 (-.01; .88)	.01 (-.43; .46)	-.14 (-.43; .16)
	p	.21	.003	.948	.056	.954	.363
RZ32	n	4	3	11	1	4	8
	OR (CI95%)	.56 (-.89; .01)	.9 (-.8; 2.6)	.45 (-.65; 1.56)	-3.1 (-64.94;58.74)	.89 (-.78; 2.56)	-.92 (-1.71; -.14)
	p	.451	.3	.419	.922	.295	.022
RZ43	n	10	17	21	9	19	10
	OR (CI95%)	.72 (-.67; .12)	.39 (-.74; 1.52)	-.13 (-1.19; .93)	1.21 (-.43; 2.84)	-.08 (-1.18; 1.02)	-.08 (-.94; .78)
	p	.308	.502	.812	.149	.885	.859
RZ56	n	157	226	143	200	241	157
	OR (CI95%)	-.12 (-.53; .29)	.25 (-.16; .66)	.03 (-.41; .48)	.09 (-.33; .5)	-.18 (-.6; .24)	.09 (-.2; .38)
	p	.568	.231	.884	.687	.397	.55
RZ61	n	174	144	158	139	157	221
	OR (CI95%)	-.07 (-.34; .21)	-.16 (-.44; .12)	.1 (-.19; .39)	-.09 (-.38; .2)	.21 (-.09; .51)	Ref. (0)
	p	.628	.267	.488	.536	.174	

Abbreviations: RT1: Rotation 1; RT2: Rotation 2; RT3: Rotation 3; RT4: Rotation 4; RT5: Rotation 5; RT6: Rotation 6; RZ: Reception zone; RZ1: Reception zone 1; RZ2: Reception zone 2; RZ4: Reception zone 4; RZ5: Reception zone 5; RZ32: Reception zone 32; RZ43: Reception zone 43; RZ56: Reception zone 56; ZR61: Reception zone 61. OR: Odds ratio. CI; Confidence Interval. p: p-value.

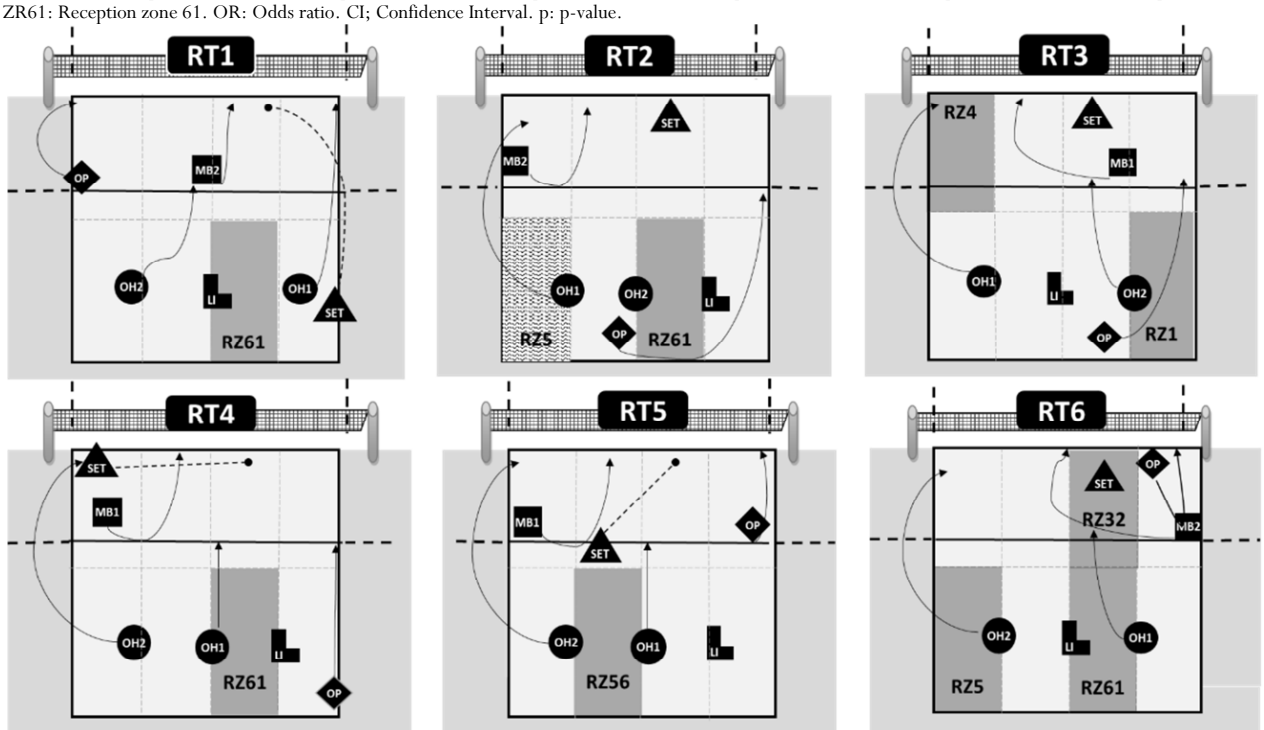

Figure 2. Reception zones with lower performance in each of the rotations as compared with RT2*RZ5. Abbreviations: SET: Setter; OH1: Outside hitter 1; OH2. Outside hitter 2; MB1: Middle Blocker1; MB2: Middle blocker 2; OP: Opposite; LI: Libero.

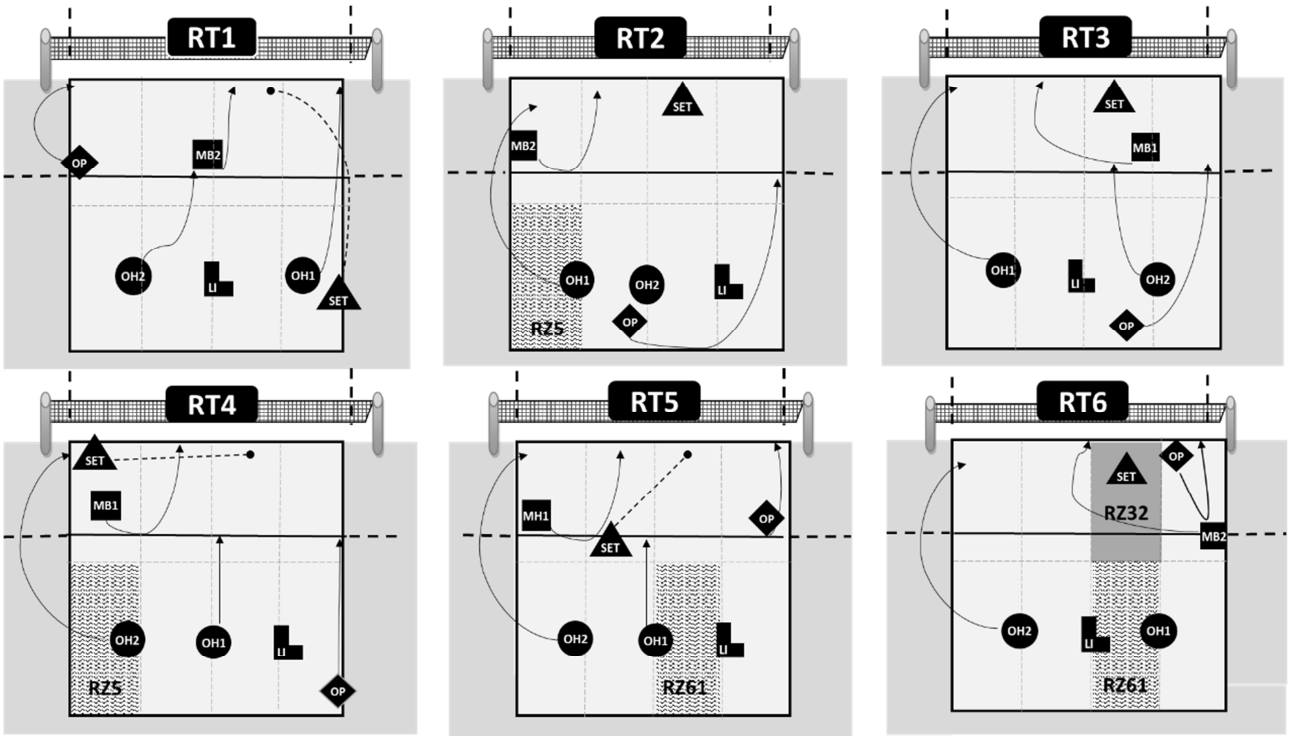

Figure 3. Reception zones with higher performance in each of the rotations as compared with RT6*RZ32. Abbreviations: SET: Setter; OH1: Outside hitter 1; OH2. Outside hitter 2; MB1: Middle Blocker1; MB2: Middle blocker 2; OP: Opposite; LI: Libero.

Discussion

The hypothesis of this research is that spike performance is related to the reception area and the rotation of the team and up to our knowledge, this is the first study to analyze the relationship of the RZ with SP of high performance male volleyball teams, considering the RT impact on this relationship.

When comparing the RZ and the RT with the SP, significant relationships were only found when studying the interaction between them. Therefore, when performing a contextualized analysis, it seems that the interaction between both variables improves the accuracy of the estimates for spike performance.

In the spike performance estimates obtained, receiving on RT2 * RZ5 performed better than other zones, just as receiving on RT4 * RZ5 performed better than RT6 * ZR32. Taking the structure of reception formed by three players as a reference, which is the most used in high-level men's volleyball (Ciuffarella et al., 2013; Paulo et al., 2016), the outside hitter in front row (OHF) receives in RZ5 at RT2 and RT4. The achievement of a better spike performance after receiving in RZ5, at least in these two rotations, runs counter to the idea that serving on OHF can reduce the team's spiking performance. Different studies done in high level men´s volleyball have considered that the reception-attack transition of the OHF can reduce its availability for the spike, thus reducing the attack´s chances of the team (Afonso et al., 2012; Grgantov et al., 2018; Marcelino et al., 2014; Paulo et al., 2016; Rocha et al., 2021; Valhondo et al., 2018), especially if we think that the outside hitter was the most requested player with non-ideal setting conditions (Martins et al., 2022), and the dominant setting for men is zone 4 (Barzouka, 2018; Grgantov et al., 2018; Tsikiva & Papadopoulou, 2008). However, in the study conducted by Molina-Martín et al. (2022), with a high-level male sample, no relationship was found between the effect of the transition effect from reception to attack and spike performance. This trend of decreased performance in spike after receiving the OHF was not observed in the previous situations, while it did occur in RT6 * RZ5. It is possible that in RT6 the highest percentage of serves made on the right side of the court (López et al., 2022), causes an imbalance of the reception structure towards that zone, generating a greater spatial responsibility in reception to the OHF both in RZ5 and in RZ61, which may hinder its transition to the spike. Similarly, lower performance was recorded in RT1 * RZ61. RT1 is the only rotation with a reception-attack transition from RZ1, so a serve towards the inside of the court could increase the receiver's displacement, making it difficult for him to join the spike and reducing his and the team´s performance.

The spike performance after receiving in RT2 * RZ5, was also superior to that observed in RT3 * ZR1, that supposes a reception area which is the exclusive responsibility of the outside hitter in back row (OHB). It was also superior when reception occurred in other zones with shared responsibility of the OHB that can hinder the transition reception-attack, or in case another player was the receptor, he occupied spatially his finishing run, jump or landing zone for the PIPE finish (RT2 * ZR61; RT4 * ZR61; RT5 * ZR56; RT6 * ZR61; RT6 * ZR32).

These results are consistent with the idea that to facilitate defense in high-level men's volleyball, it may be more effective to hinder the reception-attack transition of the

OHB, than that of the OHF. This is because while the spike in front row is carried out closer to the net, in a more favorable situation with respect to the vertical angles of spike to rival field, the spike in back row is executed behind the line of defenders and requires a more powerful previous run to allow hitting the ball into the rival field with the greatest availability of possible angles. Therefore, it seems that in transition-reception-spike situations, the spike in back row may be more affected than the spike in front row. Supporting this idea, João & Pires (2015) suggested that there is a tendency in high performance volleyball to direct the serve over the OHB, seeking to cancel its incorporation into the attack.

RT2 * RZ5 also outperformed RT3 * RZ4, which would require the OHF to get closer to the net, limiting its spike run. López et al. (2022), found a superior performance in reception after receiving in RT3 * ZR4 as compared to other rotations and back lines, while in this study we have found the opposite trend with a lower performance in the spike after receiving in this area. The use of short serves for strategic purposes trying to hinder the attack systems and reducing the performance of the teams in K1, has been raised by other authors in high-level men's volleyball (Lima et al., 2008; Maia & Mesquita, 2006). However, we cannot ignore that a relevant part of the serves received on the front zones are produced as a consequence of the change in the trajectory of the serve when contacting the net (Ciuffarella et al., 2013; López et al., 2021). Another situation with lower performance after receiving in the front zone was RT6 * ZR32 comparing it to others in which it was received in RT2 * RZ5, RT4 * RZ5, RT5 * RZ61 and RT6 * ZR61. The serve to RT6 * RZ32, could nullify the option of the OHB spike if it is him who receives, or hinder his run as a PIPE spike by the receiver occupying the running or jump zone. It can also make it difficult for the middle hitter, whose participation has a high impact on the spike performance of the teams in K1 (Millán-Sánchez et al., 2020); to move to the spike position. It can also make it difficult for the setter to place and move, as the reception and placement zone match spatially (Lima et al., 2008). Therefore, directing the serve to the RZ32 in this rotation seems a good option.

We consider that this study presents the analysis of the interaction that takes place between the rotation of the receiving team and the receiving area in a novel way, to assess its relationship with spike performance. The high homogeneity of the sample and the high competitive level of the evaluated actions belonging to an Olympic cycle, are also strong points of this work.

As practical applications, we believe that this study can provide valuable information to coaches about which zones to consider as a preferred target for the serve; In addition, it can serve as an indication of possible issues with K1 sequences that then can be trained and improved. We also believe that this research gives relevance to the contextualized study of performance based on rotations and reception zones, which can be incorporated into the performance analysis by coaches in different categories.

As a future line of work, we consider it would be interesting to consider the moment of the set as variable, and to replicate the present study in high-level women's volleyball, as well as in training categories.

Some aspects must be taken into account to interpret the results of this work. First, it should be noted that some registered categories are underrepresented, which reduces the precision of some estimations. Second, when interpreting the results, it must be taken into account that the percentage of the explained variance is small, which indicates weak relationships in general terms. But it should be noted that the effect size measures must be contextualized, adapted and interpreted according to the object of study. In high-level competitive sport, a small difference is often enough to separate victory or defeat, so these small relationships found can be decisive. Therefore, the results found may be relevant in the competitive environment. As a final limitation of the work, a convenience sampling had to be used, due to the restriction to access some competitions.

Overall, although the variance explained by the included variables is low, we can conclude that spike performance could be influenced depending on the rotation and the reception area in which a K1 action begins.

Although we consider that in the present study the data of some teams can hide the tendencies of others, the almost identical reproduction of the formal game models used by highest level male teams provoke trends in spike performance depending on the interaction of rotations and reception areas. Although an individualized study of the rival that includes the variables proposed in this study could be recommended, serving in RT6 over RZ32 and avoiding RZ61, as well as serving in RT2 over RZ61 and avoiding RZ5 seem to be applicable at high level male competition given the spike performance found after receiving in these areas.

Conflict of interest

The authors declare that there was no conflict of interest. No funding was received for this study.

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