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The Action of the Middle Blocker According to the Opposing Offensive Organization in Volleyball

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Abstract: In modern Volleyball, the block action differentiates the world-class teams. The purpose of this study is to understand what determines the action of the middle blocker in the moment that precedes the technical procedure of the block. The sample consisted of n4895 actions from 24 middle blockers, representing 30 footages of games from the 1st male volleyball division in the Portuguese league on season 2013/2014. We have also recorded the type of setting (ball tempo) of the opposing setter and the area where the opposing attack occurred. The chi-squared test analysis allowed us to establish that there is a relationship between the actions and the attack zones ($x^2 = 109.956$; $p \leqslant 0.001$), as well as between the actions and the type of setting, in each attack zone ($x^2 = 3{,}523.678$; $p \leqslant 0.001$ in all of them). Thus, we have verified that the action performs block but does not make contact with the ball that is the most frequent. We have also established that there is a strong tendency for the middle blocker to attempt to carry out the block in zones 3 and 4, to the detriment of the attack performed in defensive zone.

Key words: Volleyball, action, middle blocker, block.

1. Introduction

With the evolution of the sport over the last few years [1-4], the attack action has become the most powerful weapon for scoring points [5, 6]. In order to counteract this action, there may be a first moment for the technical procedure of the block [7]. It is possible to analyze this action from a defensive point of view (to counteract the opposing attack) and/or an offensive one, once it can result in a point for the team that performs the block [5, 6, 8, 9].

The role of the middle blocker is essential for this action. In case the ball is played in another zone, this player, besides trying to block his direct opponent (the opposing middle blocker), should perform the block in that very zone, together with a side blocker in the same zone [10]. A possible cause for the middle blocker not to have the time to perform his block (regardless of the zone where the opposing attack is carried out) is the speed of the ball in the second contact [10-12]. This situation often allows the middle blocker to anticipate the opposing setting [13, 14].

As a way to understand this action, it is crucial to understand how the technical procedure is performed. Some authors divide it into three phases [15-17] and others into four phases [18, 19]. According to the information gathered, we can describe three sequential movements in the block action. There is a first moment of pre-block, characterized by visual analysis (called initial position or anticipation) and preparation for jump, which is, the whole set of movements executed by the blocker while approaching the opposing attacker. A second moment comprises the block action per se. It includes the jump and the entry in the opposing field over the net with the intent of intercepting the ball, creating an effective block (attempt to score a point) or a defensive one (decreasing the speed with which the ball is dropped after the opposing attacker's spike, for consequent defense and exit for counterattack). Finally, there is a third moment, consisting of the descending phase or fall phase.

Our study focuses on the action that precedes the

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technical procedure of the block (1st moment). Before we focus on the technical procedure, it is important to understand what factors influence the response—or lack of it—of the middle blocker. In this moment, one of three situations can occur: (1) the middle blocker does not arrive in time to perform the block or does not respond to the type of pass of the opposing setter; (2) the middle blocker performs the block but cannot make contact with the ball; (3) the middle blocker performs the block and makes contact with the ball.

This is a groundbreaking investigation and, therefore, we have found no references regarding this theme. The present study aims to understand what makes the middle blocker execute his actions mentioned in the previous paragraph, considering the type of opposing setting and the opposing attack zone as variables.

2. Methodology

2.1 Sample

The sample is made up of 4,895 actions performed by 24 middle blockers in the block action, coming from the 105 sets corresponding to 30 games of the national league of the 1st Portuguese male division—season 2013/2014. We have chosen games in which at least one of the teams was in the top 6 of the final score of the season.

2.2 Reliability of the Observation

In order to check for the consistency of the observation, we have verified the percentage of intra-observer and inter-observer agreements (both observations occurred with a gap over 15 days). We have observed 979 actions (20% of the total sample), a value above the minimum of 10% accepted by the literature [20]. The results obtained have shown percentages of agreements above the minimum values indicated, which is, 80% [21]. The minimum value obtained was 95.8% in the variable "type of attack" (inter-observer reliability) and the maximum value was 100% in the variable "attack effect" (inter-observer) and "situational opposition of the block" (intra and inter-observer). In order to exclude the possibility of random agreements, we have applied the Cohen's kappa coefficient. The recorded values stood between 0.96 and 1 in terms of intra-observer reliability and between 0.94 and 1 in the inter-observer reliability, well above the reference values considered high by the literature (0.75) [22]. The values obtained in both procedures have proven their reliability for use as a scientific measurement.

2.3 Instruments and Variables

In order to analyze objectively and precisely the movements that precede the technical procedure of the block, we have used the Kinovea software.

For a clear framework of the movements used by middle blockers, we have considered the following variables:

- Ball tempo of the opposing setter (Fig. 1);
- Zone where the attack is performed: Zone 1, Zone 2, Zone 3, Zone 4, Zone 5 and Zone 6;
- Action of the player: Does not block (DNB); Blocks but does not make contact the ball (BNC); Blocks and makes contact with the ball (BC).

2.4 Procedures

We have established an initial contact with the teams' coaches via e-mail, requesting authorization for recording the games of their teams. After obtaining the authorization from all coaches, we have obtained access to the footage from each round via Dropbox, which gave us access to images of formal game context. The cameras were placed in the most central point at the bottom of the game field, paralleling to the net line, for recording images of all the motion of the middle blockers in the game near the net.

The footage was recorded in.avi files. The files were exported to Kinovea software, available at http://www.kinovea.org/fr/, for tagging and checking the trajectory covered by fixed points in the lower limbs. We have also used Microsoft Excel 2010 to create the record sheets of each game and to transfer

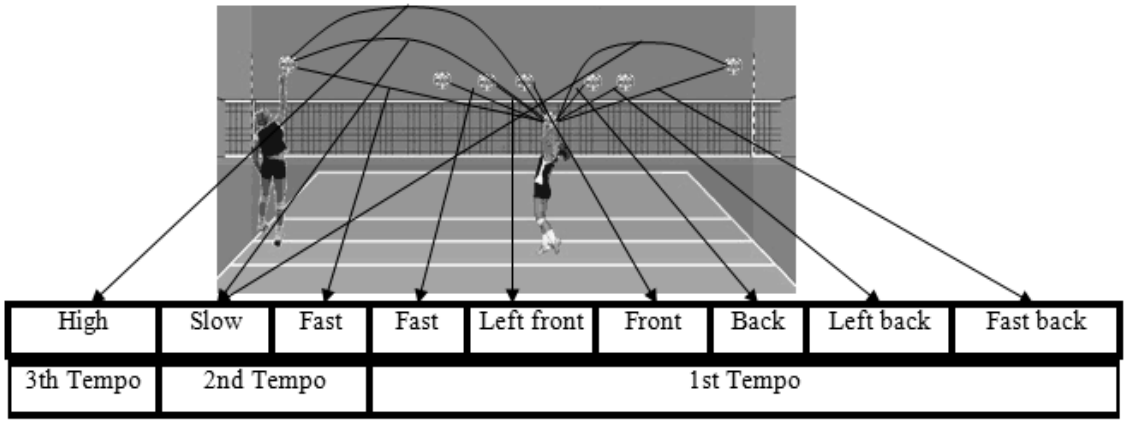

Fig. 1 Different setting played by setters (adapted Ref. [23]).

data to the statistics software IBM® SPSS® version 21 for analyzing the variables.

2.5 Statistical Analysis

The sample was characterized and described using descriptive statistics. We used a chi-square test to determine the middle blocker action, the different types of setting and the attack zones. All the statistical analysis was performed using SPSS 21.0 for Windows. Statistical significance was set at $p < 0.05$.

3. Results

The values regarding the frequency values of the middle blocker (MB) action are shown in Table 1. Data show that, in 55% of the actions, the middle blocker blocks but does not make contact with the ball (BNC); in 30%, he blocks and effectively makes contact with the ball (BC), and in 15% of the actions, he does not block (DNB). Regarding the attack zone, we have concluded that 70% of the action is executed from zones 2 and 4. The most frequent balls are the ones passed in 3rd tempo and 2nd tempo slow (22.5% and 34%, respectively).

By analyzing Table 2, we notice the relationship between each MB's action and the zone of the opposing attack. The attacks coming from the defense zones (1, 6 and 5) were those that caused the DNB action more often, specifically 25%, 24.5% and 42.1%, respectively. Regarding the attack zones (2, 3 and 4), the zone that shows a smaller percentage of the DNB action is zone 3 (7.7% of the total number of attacks).

Within the same relationship, but now focusing on the BNC action, we have noticed a balance of this middle blocker action concerning the several zones of opposing attack. In fact, the percentage ranged from 47.4% (attack from zone 5) and 59.5% (attack from zone 3).

The analysis of the MB action revealed that the attacks coming from zone 5 caused less contacts in the block action of the middle blocker (only 10.5% of the balls made contact with the block), followed by zone 1, where only 20.1% of the total number of attacks made contact with the block. On their turn, the attacks performed in zones 3 and 4 have caused more than 30% of balls contacted in each zone. Finally, the attacks coming from zones 2 and 6 have obtained an equal percentage value (27.8% of attacks that made contact with the block action of the middle blocker).

The chi-square analysis has demonstrated that there is a statistically significant relationship between the two variables ($x^2 = 109.956$; $p = 0.0$).

We have also considered the type of setting performed by the opposing setter, according to the zone, in order to understand if there is a relationship between the tempo of set-to-attack and the action of the middle blocker. Here again, the chi-square analysis has demonstrated that there is a statistically significant relationship between the variables ($x^2 = 3{,}523.678$; $p = 0.0$).

Table 1 Frequency of the MB's actions, opposing attack zone and ball tempo from the opposing setter.

		n	%
Action	Does not perform block	756	15.4
	Performs block but does not make contact the ball	2,689	54.9
	Performs block and makes contact	1,450	29.6
Opposing attack zone	Zone 1	224	4.6
	Zone 2	1,451	29.6
	Zone 3	1,023	20.9
	Zone 4	1,947	39.8
	Zone 5	38	0.8
	Zone 6	212	4.3
Ball tempo of the opposing setter	3rd tempo	1,101	22.5
	2nd tempo-slow	1,666	34.0
	2nd tempo-fast	792	16.2
	1st tempo-fast	213	4.4
	1st tempo-left front	195	4.0
	1st tempo-head	533	10.9
	1st tempo-back	264	5.4
	1st tempo-left back	89	1.8
	1st tempo-fast back (China)	42	0.9

Table 2 Relationship between the player's action and the opposite attack zone.

			Opposing attack zone					
			Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Player's action	DNB	Total number of attacks	56	261	79	292	16	52
		% of the MB's action	25.0%	18.0%	7.7%	15.0%	42.1%	24.5%
	BNC	Total number of attacks	119	786	609	1,056	18	101
		% of the MB's action	53.1%	54.2%	59.5%	54.2%	47.4%	47.6%
	BC	Total number of attacks	49	404	335	599	4	59
		% of the MB's action	21.9%	27.8%	32.7%	30.8%	10.5%	27.8%
		Total	224	1,451	1,023	1,947	38	212
			100%	100%	100%	100%	100%	100%

MB—Middle blocker; DNB—Does not block; BNC—Blocks but does not make contact with the ball; BC—Blocks and makes contact with the ball; $p = 0.000$.

We only present the attack zones (2, 3 and 4) and, once they represent over 90% of the total number of attacks of our sample (Table 2).

Focusing our attention on zone 3, we were able to determine that about 74% of the attacks derive from the type of distribution 1st tempo head, 1st tempo left and 1st tempo fast, as described in Table 3. Within these attacks, we can establish that the tempo of set-to-attack that originated the more contacts in block (BC) was the 1st tempo left front in 37.9% of the attacks, and 1st tempo head was the one that caused fewer contacts, in only 30.5% of the cases. In turn, the BNC action read values between 55.0% (1st tempo fast attack) and 64.1% (1st tempo head attack). The ball tempo that promotes the DNB the most is 1st tempo fast (7.9%) and the one that does it the least is 1st tempo left front (4.6%).

In zone 4 (please refer to Table 4), about 93% of the attacks are performed after the passes 3rd tempo, 2nd tempo slow and 2nd tempo fast. In attacks coming from this zone, the middle blocker has percentages that are very close to one another in all actions. Regarding BC, the variation lies between 29.9% (2nd tempo slow attack) and 31.9% (2nd tempo fast attack). Concerning

Table 3 Relationship between the MB's action/zone 3 and the type of setting.

			Ball_tempo								
			3rd tempo	2nd tempo slow	2nd tempo fast	1st tempo fast	1st tempo left front	1st tempo head	1st tempo back	1st tempo left back	1st tempo fast back (China)
Action_Zone	DNB	Total number of attacks	9	12	4	12	7	24	10	1	0
		% of the MB's action	14.3%	17.9%	6.7%	7.9%	4.6%	5.3%	18.2%	4.5%	0.0%
	BNC	Total number of attacks	31	38	39	83	88	288	27	12	3
		% of the MB's action	49.2%	56.7%	65.0%	55.0%	57.5%	64.1%	49.1%	54.5%	100.0%
	BC	Total number of attacks	23	17	17	56	58	137	18	9	0
		% of the MB's action	36.5%	25.4%	28.3%	37.1%	37.9%	30.5%	32.7%	40.9%	0.0%
	Total	63		67	60	151	153	449	55	22	3
		100%		100%	100%	100%	100%	100%	100%	100%	100%

MB—Middle blocker; DNB—Does not block; BNC—Blocks but does not make contact with the ball; BC—Blocks and makes contact with the ball; $p = 0.000$.

Table 4 Relationship between the MB's action/zone 4 and the type of setting.

			Ball_tempo					
			3rd tempo	2nd tempo slow	2nd tempo fast	1st tempo fast	1st tempo left front	1st tempo head
Action_Zone	DNB	Total number of attacks	106	108	67	4	3	4
		% of the MB's action	16.9%	14.5%	15.6%	6.5%	7.1%	10.5%
	BNC	Total number of attacks	328	415	226	36	25	26
		% of the MB's action	52.1%	55.6%	52.6%	58.1%	59.5%	68.4%
	BC	Total number of attacks	195	223	137	22	14	8
		% of the MB's action	31.0%	29.9%	31.9%	35.5%	33.3%	21.1%
	Total		629	746	430	62	42	38
			100%	100%	100%	100%	100%	100%

MB—Middle blocker; DNB—Does not block; BNC—Blocks but does not make contact with the ball; BC—Blocks and makes contact with the ball; $p = 0.000$.

Table 5 Relationship between the MB's action/zone 2 and the type of setting.

			Ball_tempo						
			3rd tempo	2nd tempo slow	2nd tempo fast	1st tempo head	1st tempo back	1st tempo left back	1st tempo fast back (China)
Action_Zone	DNB	Total number of attacks	42	92	58	10	43	7	9
		% of the MB's action	15.3%	17.2%	20.7%	21.7%	20.6%	10.4%	23.1%
	BNC	Total number of attacks	139	298	146	24	118	42	19
		% of the MB's action	50.7%	55.6%	52.1%	52.2%	56.5%	62.7%	48.7%
	BC	Total number of attacks	93	146	76	12	48	18	11
		% of the MB's action	33.9%	27.2%	27.1%	26.1%	23.0%	26.9%	28.2%
	Total		274	536	280	46	209	67	39
			100%	100%	100%	100%	100%	100%	100%

MB—Middle blocker; DNB—Does not block; BNC—Blocks but does not make contact with the ball; BC—Blocks and makes contact with the ball; $p = 0.000$.

BNC, the percentages range from 52.1% (3rd tempo attack) and 55.6% (2nd tempo slow attack). Finally, the DNB action also reads values close to one another, between 14.5% (2nd tempo slow attack) and 16.9% (3rd tempo attack).

In zone 2, about 90% of the attacks are performed after the settings 3rd tempo, 2nd tempo slow, 2nd tempo fast and 1st tempo back (please refer to Table 5). The ball tempo that causes the middle blocker to contact the ball the most is 3rd tempo (33.9% of the total number of attacks), and 1st tempo back is the attack that leads to a smaller percentage of contacts (23% of the total). Concerning BNC, the values range from 50.7% (3rd tempo attack) and 56.5% (2nd tempo back attack). The ball tempo that causes the DNB action varies between 15.3% (3rd tempo attack) and 20.7% (2nd tempo fast attack).

4. Discussion

Considering the lack of studies to support our results, we believe that the frequency obtained is regular. The middle blocker does not try or does not get to block the ball in only 15% of the opposing attacks. This datum proves the importance of this technical procedure for scoring points, as stated in some studies [5, 6]. Ref. [8] also support this premise, affirming that this technical procedure is the second most important, right after the spike.

When we analyze the actions according to the zone where the opposing attack is performed, we are able to understand that the defense zones are those that cause a higher percentage of non-execution of the block. This is an expected result, considering the concern of the middle blocker in trying to execute his block in the attack zones (zones 2, 3 and 4), neglecting the attacks coming from defense zones (zones 1, 6 and 5). We believe that it is also logical that the zone of the opposing attack that promotes the DNB action the less is zone 3, once it is the closest to the place where the middle blocker is, which, on the other hand, reveals the little mobility and creativity of the attacking middle blockers and setters from the rival to create more creative and faster plays [10, 13, 14].

While checking the action in which the player tries to execute his block but does not make contact with the ball (BNC), we have obtained intriguing datum. Though the values fluctuate only 12.1% in the six zones, the zone where there is a higher percentage of block attempts without making contact with the ball is the zone immediately opposite to the middle blocker, which is, zone 3. It is likely that this happens due to the attack combinations resulting from the variation of distribution (please refer to Table 2) that the opposing setters create with their attacking middle blockers. This favors quick changes in positioning and forces the BC to quickly adapt to those variations [12], although he does not make contact with the ball most of the plays. Another possible explanation is the anticipation of the player's action, as stated in a few studies [13, 14]. Due to the high speed used in the execution of the opposing attack, the BC has to anticipate actions very often. If he is already in a flight stage, he cannot react to small changes in the ball tempo and, consequently, he does not make contact with the ball coming from the opposing attacks.

The data indicate that this move is seen most frequently in attacks coming from zones 3 and 4, considering the middle blocker's BC action. These values are justifiable because both zones are attack zones, usually occupied with attacking players in all six rotations (it should also be noted that the zone 2 is usually occupied by the setter during 3 rotations). The zones 1 and 5 (defense zones) are those who least foster the BC action. We believe that these values are normal, considering that the aforementioned zones are the two most distant zones from the player's position. Therefore, the attacks from these zones are considered far less dangerous. In zone 2 (usually occupied by one attacker in three of the six formations) and zone 6 (the zone immediately behind the zone closest to the middle blocker) the BC action has read average values.

The results reveal a curious datum, after considering the three variables studied. Among the three more

frequent passes executed by the setter in zone 3, the one most frequently blocked by the middle blocker is the 1st tempo fast, i.e., the one closest to the zone 4. This datum reveals the player's tendency for blocking in both zones (3 and 4). Another possible explanation is that, considering that this is a fast but more distant pass from the setter, this is a ball tempo that requires more technique in its execution for both the setter and the attacker [10, 13, 14]. In all three setting types, and proving the last sentence, the pass the least blocked by the middle blocker was the 1st tempo head, i.e., the most distant pass from zone 4.

By observing the zone 2 attacks and considering the 4 most frequently used types of setting for this very zone, it is possible to conclude that the tempo that results in less contact with the ball was the 1st tempo back, once again confirming the middle blocker's tendency for moving to the opposite zone (zone 4). Therefore, the tempo with the highest percentage of contacts by the middle blocker is the 3rd tempo, i.e., a type of set that provides more time for the middle blocker's movements while trying to block.

While checking the zone 4 attacks, it is possible to conclude that the values from the several actions (DNB, BNC and BC) are similar to the global values of the actions (please refer to Table 1). The middle blocker's action is quite similar, regardless of the several types of pass executed by the opposing setter. The data confirm what has been mentioned before, i.e., there is a strong tendency for this player to block its direct zone (zone 3) and the zone with the most attacks recorded (zone 4).

In addition, there is something curious related to the fact that the tempos of set-to-attack used the most frequently are the 3rd tempo and 2nd tempo slow. This might be one of the causes for the 85% of actions (55% BNC + 30% BC) where the middle blocker tries to contact the ball through the technical procedure of the block.

5. Conclusions

Zones 2 and 4 are the most frequently used for attacks. However, the middle blocker has shown a strong tendency for blocking zones 3 and 4. They are also the zones that foster the contact of the middle blocker with the ball more frequently. However, the blocks with 1st tempo in zone 3, 1st tempo back in zone 2 and 2nd tempo slow in zone 4 require more work, once they are the blocks that created more situations in which the middle blocker did not make contact with the ball.

The training should also cover the attacks from defensive zones, once they are the ones that promote the non-execution of the block. Considering that the contact is executed farther away from the net, there is a gap between the moment when the opposing attacker makes contact with the ball and the moment when the middle blocker should jump, quite different from the attacks coming from the attack zone.

Although it is not one of the purposes of this study, the data revealed that the most frequently used tempos are the 2nd tempo slow and the 3rd tempo. Therefore, it is obviously important to work in faster tempos to create situations more dangerous for the attackers to score points and difficult situations for the organization of the opposite blocking action.

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