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A Study on Support Play in Soccer Games: Relationship between Player Positioning and Zone

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Abstract

In football, the off-ball movements of receivers, such as in support, are important maneuvers to achieve collective play. However, the objectification of the indicators of support play is not clear. Therefore, the purpose of this study was to examine the relationship between player positioning and zone in support play. Using tracking data and scouting footage from three matches in the 2019 season of Japan's top football league, the J1 League, a total of 724 cases of a diamond shape (DS) surrounding an opposing defender when receiving a pass under pressure were analyzed. The following results were observed: 1) The occurrences of Offensive Advantage DS-2 and Offensive Advantage DS-3 were significantly higher in the Defending Zone (DZ) (23.1% and 16.3%, respectively) and Middle Zone (MZ) (25.7% and 14.9%, respectively) than in the Attacking Zone (AZ) (14.8% and 5.6%). 2) The occurrence of Defensive Advantage DS-0 was significantly higher in the AZ (3.5%) than in the MZ (1.2%). These findings suggest that the DS positioning and coordinated ball receiving moves by players close to the ball carrier may be effective in the DZ and MZ, but not in the AZ where the priority is to play for a goal.

1. Introduction

The movements of a player in a soccer game are generally classified into movements with and without the ball. A player with the ball requires a supporting re-

ceiver to be able to pass (Griffin et al., 1999). Terada (2018) also stated that the receiver needs to be the initiator of the pass, as it is too late to move after the receiver feels that the sender is going to pass. Thus, the receiver's off-ball (without the ball) movements, such as those observed in support, are important maneuvers for achieving collective play.

As for support, a type of off-ball movement is defined as "a move that helps the ball carrier, such as creating a passing path for a teammate who has the ball" (JFA, 2020). Regarding support practices, several studies have discussed the optimum number of support players required. Some studies suggest two players (Wade, 1967; Ooft, 1994; Mercier & Cros, 1964), others three to four players (Laurier, 1993; Yoshimura et al., 2002), and some even recommend up to 10 players (JFA, 2018). As with the number of players, there are also various suggestions regarding the distance of this support to the ball carrier; 4 - 5 m in the offensive zone and 9 - 27 m in the midfield and defensive zones (Hughes, 1974, 1984, 1996); approximately 12 m (Okihara et al., 2000); while others merely state that an appropriate distance should be used (JFA, 2020; Ooft, 1994; Yoshimura et al., 2002). Concerning player placement in relation to each other, it is reportedly ideal for the three players without the ball to form a diamond shape ("DS") with the ball carrier as the starting point (Okada, 2019). There are various reports on timing as well (Hughes, 1996; JFA, 2020; Matsubara, 2011; Okada, 2019; Sakakibara & Tsuchida, 1999). As mentioned above, although the concept of support is defined, indicators regarding specific practices vary depending on the study or instructional documents, and the objectification of the indicators of support play is still unclear.

On this basis, Matsubara et al. (2022), using tracking data from three J-League games, investigated the relationship between the number of players and the distance from the ball carrier at the moment when the receiver receives a pass in the offensive phase. The results showed that DS between the ball carrier and three non-ball carriers at approximately 13 - 24 m was associated with a higher likelihood of coordinated group support play. However, it has been reported that the form of cooperative play varies according to the zone (JFA, 2020; Hughes, 1974, 1984, 1996). Therefore, it is necessary to consider whether the DS formation is effective for support play regardless of the zone. Furthermore, soccer games involve "direct confrontation with the opponent" (Stiehler et al., 1993), and the study by Matsubara et al. (2022), which measured the positional relationships of only offense team players, lacked an examination of positional relationships with opposing defensive players. To play forward while passing the ball together, it is necessary to attempt to receive the pass according to the defender's position (Okada, 2019), and this becomes more important when the more pressure is applied (Hughes, 1996). In addition, the DS arrangement is one that provides all-round support to the ball carrier, i.e., it can create multiple passing paths for the ball carrier as the participating players move in coordination with each other (Okada, 2019; Ono, 1998; Sakamoto, 2021; Wade, 1967). Additionally, players around the ball carrier need to move around the opponent's defenders

so that they can safely receive passes (Kazama, 2021). From the above and based on the viewpoint of Matsubara et al. (2022), to consider the indicators of support play more practically, it is necessary to measure the DS formed by the player who can receive the ball in relation to the opponent defender who is applying the pressure.

The purpose of this study was to examine the relationship between player positioning and zone in group support play by classifying DS by the number of players who can receive the ball in DS surrounding the opposing defender under pressure and by clarifying the occurrence rate of each DS in each zone.

2. Methods

2.1. Specimens

The "specimens" are three games from the 2019 season of Japan's top league, namely, the Meiji Yasuda Seimei J1 League (hereafter referred to as "JL"). The games chosen were played between the top four teams in the league to gather data on effective play practices. Furthermore, the results of the games chosen were all within one goal of each other to minimize the effect of goal difference on performance (Team A vs. Team B [result: 0 - 0], Team C vs. Team A [result: 2 - 2] and Team C vs. Team D [result: 2 - 1]). In these three matches, a total of 724 "cases" were selected using tracking data licensed from the Data Stadium Corporation and scouting videos licensed from J-League Co.

2.2. Analysis Methods

Tracking data were used to measure the presence or absence of pressure and of a DS formation. In addition, we used scouting videos to analyze play and measure the ability of non-ball carriers to receive the ball. To do this, scouting videos were used as data, and Hudl (Hudl, Inc.) was used to play and pause the video for each target case. One author performed all measurements. The definition of pressure, each classified DS, characteristics of the data and video, method of selecting measurement cases, and measurement items are described below.

2.2.1. Pressure

We referred to the definition of pressure given by Tanaka (1986), which states, "pressure is the act of restricting the opponent's offense, preventing them from passing the ball freely." Thus, we defined pressure as the situation in which the defender is in a position to intervene in all of the ball carrier's passing options and is therefore closer to the ball carrier than they are to the nearest allied player.

2.2.2. Diamond Shape

The definition of DS was based on that described by Matsubara et al. (2022) and was defined as follows: any case wherein angles CAB, CAD, ACB, and ACD in quadrilateral ABCD, which is formed by connecting ball carrier A and three teammates (B, C, and D), are between 0° and 90° (Figure 1).
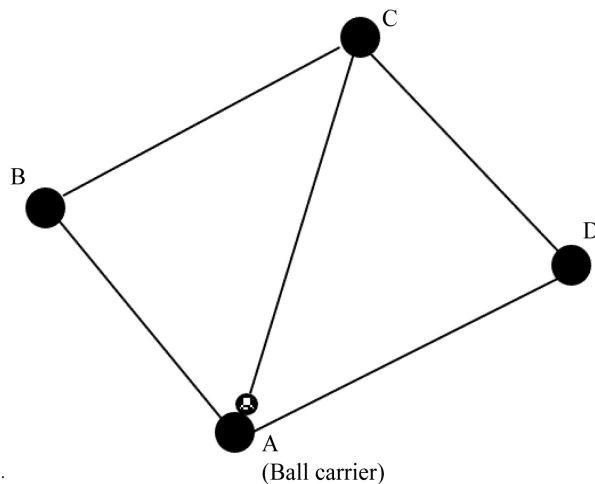
Figure 1. Diamond shape (Reproduced from Matsubara et al., 2022).

2.2.3. Around the Defender Diamond Shape

In a game, several DSs can be formed around the ball carrier. The DSs that 1) are located closest to the ball carrier, 2) have no teammates inside, and 3) are formed around the defender closest to the ball carrier ("first DF") are designated Around Defender Diamond Shapes ("ADDS") (Figure 2). Furthermore, the ADDSs, which are classified into four categories according to the number of players who can receive the ball (0 - 3 players), are explained below. In some cases, there were multiple DSs in one analysis target case. In this case, the classification was given as the DS with the largest number of possible ball receivers. The distance from the ball carrier for each DS was defined as the distance from the ball carrier to the farthest of the three non-ball carriers constituting the DS.

2.2.4. Offensive Advantage Diamond Shape

A DS in which two or more of the three non-ball carriers comprising the ADDS could receive the ball was considered to be an advantageous DS for the offense team and was designated as an Offensive Advantage Diamond Shape ("OADS") (Figure 3). Furthermore, we classified those DSs in which two players could receive the ball as OADS-2 and those in which three players could receive the ball as OADS-3. This was defined as such because it is considered necessary in support play for the ball carrier to move so that even if the first DF prevents one pass option, the nearest players can still secure the remaining pass options (Ooft, 1994).

2.2.5. Defensive Advantage Diamond Shape

DSs in which only 0 - 1 of the three non-ball carriers making up the ADDS were able to receive the ball were considered to be DSs that favored the defending team and were therefore classified as a Defensive Advantage Diamond Shape ("DADS") (Figure 4). Furthermore, we classified DSs with no player available to receive the ball as DADS-0 and those with one player available to receive the ball as DADS-1.
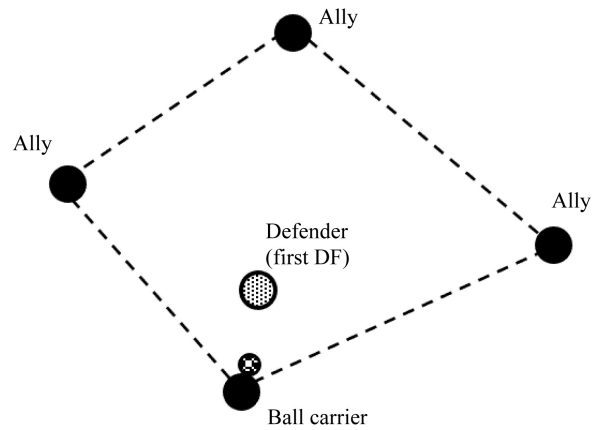
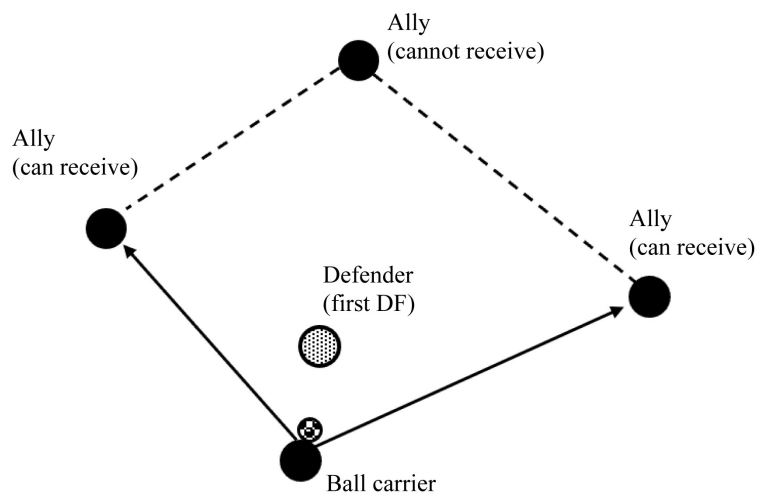**Figure 2.** Example of an around defender diamond shape.

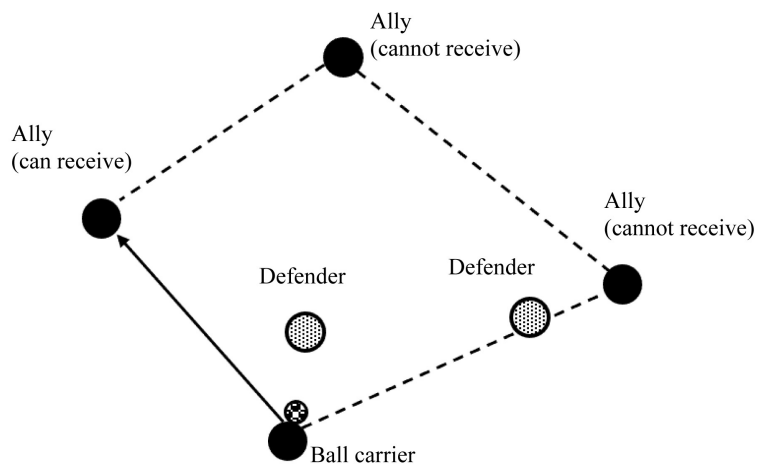**Figure 3.** Example of an offensive advantage diamond shape.

Figure 4. Example of a defensive advantage diamond shape.

2.2.6. Characteristics of the Data Used

The tracking system involved a special camera installed in the stadium to capture images of the entire pitch and data on the movements of the players, balls,

and referees (J-League, 2015). The data format used in this study was a spreadsheet, which is a file of spatiotemporal information recorded at the time when ball play (the first and last ball touch of a player) occurs. The information stored in the file, including the time of play, name of play (trap, pass, etc.), coordinates of all players on the field (the origin is the center of the pitch), distance to the ball carrier, and team holding the ball, is arranged in chronological order.

2.2.7. Characteristics of the Image Used

The scouting video was filmed by a camera located in the upper center of the stadium's main stand so that the movements of all 20 field players could be observed at all times.

2.2.8. Method of Sorting Measurement Cases

From the 1945 cases analyzed by Matsubara et al. (2022) at the moment when the receiver first touches a ball passed by a teammate in the offensive phase, we used tracking data to identify the following: 1) cases where there was pressure from the defending team (1632 cases), 2) cases where the DS was within 30 m of the ball carrier (1532 cases), and 3) cases where the DS closest to the ball carrier surrounds the first DF (724 cases).

Play was classified into four phases according to Matsubara et al. (2022), as follows: offense, transition from offense to defense, defense, and transition from defense to offense (JFA, 2020). The transition from defense to offense was defined in the tracking data as the period at which possession switches to the offensive team until the first pass connects with a receiver, while the offensive phase was defined as the period from then on until possession switched to the opposing team.

2.3. Measurement Items

2.3.1. Number of Players Who Can Receive the Ball

After video-based play analysis was used to measure the ability of the non-ball carriers comprising the ADDS to receive the ball, they were classified into four categories as follows: OADS-2, OADS-3, DADS-0, and DADS-1, depending on the number of players.

Concerning the measurement criteria of the player who can receive the ball, Terada (2018) listed voice, eye contact, gesture, movement, and being in an easy position to pass the ball as ways for the receiver to request the ball. Moreover, Griffin et al. (1999) listed the evaluation criteria of support as "to receive the pass by staying in the appropriate position or moving," and in this study, a non-ball carrier was considered a player who is likely to receive the ball if the behavior at the moment of the ball carrier's first ball touch satisfied both of the following:

1) Gaze: Face towards the ball carrier

2) Positioning: No defender between you and the ball carrier and not in an offside position

2.3.2. Incidence of Offensive and Defensive Advantage Diamond Shapes

The zone-specific raw occurrence was measured for OADS-2, OADS-3, DADS-0, and DADS-1. The occurrence rate is the percentage of cases in which a DS occurred relative to the total number of cases in which the ball carrier received a pass in the offensive phase in a situation of pressure (147 cases in the defending zone, 892 in the middle zone, and 593 in the attacking zone; 1632 cases in total). If there were several DSs in a single analyzed case, the occurrence was counted as one.

The zones were divided into three equal parts parallel to the goal line as seen in Figure 5, with the defending zone ("the DZ"), middle zone ("the MZ"), and attacking zone ("the AZ") from the own goal side, referring to Hughes (1996), Pollard & Reep (1997), and Kido et al. (2002).

2.4. Statistical Analysis

2.4.1. Reliability

To examine the reliability of the recorded measurements of players able to receive the ball obtained from play analysis, the agreement of the analysis records between the two analysts was examined with reference to Yamada et al. (2010), Costa (2010), and Suzuki et al. (2019). The same analysis was conducted on 85 cases and 261 players by an individual who had played and coached football and was engaged in scientific research on football, as well as by the author. The agreement rate (=number of agreements/(number of agreements + number of disagreements)) was determined for each measurement item based on the analysis results of both individuals. The measurements were made separately, and the interpretation of the agreement rate values was based on Siedentop & Tannehill (1999).

2.4.2. Comparison of the Offensive and Defensive Advantage Diamond Shape Occurrence between Zones

For each of OADS-2, OADS-3, DADS-0, and DADS-1, the z-test was used to test for differences in the occurrence rates between the three zones. Bonferroni's method was used for back-testing. The significance level for the statistical tests was 5%.
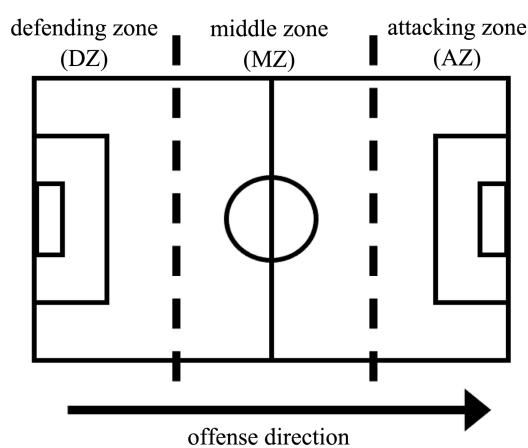

Figure 5. Zone division (Trisection).

3. Results

3.1. Agreement of the Measurement Records

The agreement of the measurement records obtained from the play analysis regarding the player who can receive the ball was >95% for all items as shown in Table 1, which is a satisfactory agreement.

3.2. Occurrence of Offensive and Defensive Advantage Diamond Shapes

In 724 cases where there was an ADDS within 30 m of a ball carrier under pressure, the ability of the non-ball carriers comprising the ADDS to receive the ball was measured. The number of occurrences, classified by the number of players who could receive the ball in each of the DS formations (Defensive Advantage DS-0 [DADS-0] [0 players who can receive the ball], DADS-1 [1 player], Offensive Advantage DS-2 [OADS-2] [2 players] and OADS-3 [3 players]), are shown in Table 2. OADS-2 occurred most frequently (351), while DADS-0 occurred least frequently (33).

3.3. Offensive and Defensive Advantage Diamond Shape Occurrence Rate by Zone

Table 3 shows the occurrence rate of OADS-2, OADS-3, DADS-0, and DADS-1 in each zone in a total of 1632 cases (147 cases in the DZ, 892 cases in the MZ, and 593 cases in the AZ) when, in a pressure situation, a receiver first touched a ball passed from a teammate in the offensive phase.

Table 1. Agreement of measurement records.

Measurement	Consistency
One's gaze	99.6%
Positioning	97.3%
Players who can receive the ball	97.7%

Note 1: Gaze: Face towards the ball carrier. Note 2: Positioning: No defender between you and the ball carrier, no offside position. Note 3: Players who can receive the ball: Players who satisfy Note 1 and 2.

Table 2. Number of offensive and defensive advantage diamond shape occurrences.

Frequency (n = 724)	
Offensive Advantage DS-3 (3)	190
Offensive Advantage DS-2 (2)	351
Defensive Advantage DS-1 (1)	150
Defensive Advantage DS-0 (0)	33

Note 1: Numbers in parentheses ( ) indicate the number of players able to receive the ball. Note 2: DS: Diamond shape.

Table 3. Offensive and defensive advantage diamond shape occurrence rates.

	Defending zone		Middle zone		Attacking zone		Difference
	Occurrences	Occurrence rate	Occurrences	Occurrence rate	Occurrences	Occurrence rate	
Cases of pressure	147		892		593		
Offensive advantage DS-3 (1)	24	16.3%[a]	133	14.9%[b]	33	5.6%[c]	*a, b > c
Offensive advantage DS-2 (2)	34	23.1%[a]	229	25.7%[b]	88	14.8%[c]	*a, b > c
Defensive advantage DS-1 (3)	14	9.5%	69	7.7%	67	11.3%	
Defensive advantage DS-0 (4)	1	0.7%	11	1.2%[b]	21	3.5%[c]	*b < c
Around defender DS (1-4)	73	49.7%[a]	442	49.6%[b]	209	35.2%[c]	*a, b > c

Note 1: DS: Diamond shape; Note 2: Around defender DS is the total of (1) - (4); Note 3: *$p < 0.05$.

The occurrence rate of DADS-0 was significantly lower in the MZ (1.2%) than in the AZ (3.5%) ($p < 0.05$). The occurrence rate of OADS-2 was significantly higher in the DZ (23.1%) and the MZ (25.7%) than in the AZ (14.8%) ($p < 0.05$). The occurrence rate of OADS-3 was significantly higher in the DZ (16.3%) and the MZ (14.9%) than in the AZ (5.6%) ($p < 0.05$). In addition, the occurrence rate of ADDS, which is the total of OADS-2, OADS-3, DADS-0, and DADS-1, was significantly higher in the DZ (49.7%) and the MZ (49.6%) than in the AZ (35.2%) ($p < 0.05$).

4. Discussion

The occurrences of Offensive Advantage DS-2 (OADS-2) and OADS-3 were significantly higher in the DZ (23.1% and 16.3%, respectively) and the MZ (25.7% and 14.9%, respectively) than in the AZ (14.8% and 5.6%, respectively). In other words, the situation where the players around the ball carrier take up the DS position around the first DF, and where two or more players can receive the ball, is present in approximately 40% of the cases of pressure in the DZ and the MZ, while in the AZ it is present in only approximately 20%.

Moreover, the occurrence of Defensive Advantage DS-0 (DADS-0) was significantly higher in the AZ than in the MZ. In other words, a higher percentage of situations existed in the AZ than in the MZ, where players were in a DS arrangement surrounding the first DF but none of them could receive the ball.

The first reason for these results is considered to be the passive influence of the defending team's play. The closer to the opponent's goal, the closer the guarding of the defending team becomes, and the narrower the space available for play (Wade, 1967); thus, the more difficult it becomes for the AZ to move into a position to receive the ball. The second reason could be the active influence of the offense team's changes in how they play. Playing to advance while retaining the ball is prioritized in the DZ and MZ (JFA, 2020; Okada, 2019; Stiehler et al., 1993), whereas the AZ is a zone where goal-oriented play is prioritized and where intentional movements away from the ball carrier increase to take advan-

tage of individual breakthrough play or to receive passes towards the direction of the goal (JFA, 2020; Okada, 2019). In addition, in the AZ, as the opportunity for the receiver to receive the ball near the opponent's final defense line inevitably increases, it is more difficult for nearby allies to move around the first DF without being in an offside position. This may have contributed to the decrease in the OADS occurrence rate. However, the OADS occurrence rate relative to the number of ADDS occurrences was 79.5% (58/73 cases) in the DZ, 81.9% (362/442 cases) in the MZ, and 57.9% (121/209 cases) in the AZ. Thus, it was inferred that this effect was not the only one.

The occurrence of ADDS was significantly lower in the AZ than in the DZ or MZ. These results suggest that players near the ball carrier may move differently in the AZ where the play to score a goal is prioritized than in the DZ and MZ, such as coordinated movements without DS formation or at a slightly further distance from the ball carrier. However, it is difficult to consider this further in this study because only the closest DS was measured; thus, this remains an issue for further investigation.

These results indicate the following: 1) in the DZ and MZ, the OADS generation rate was thought to have increased as players near the ball carrier attempted to support the ball carrier by moving coordinately to receive passes, suggesting that support play while forming a DS is an effective move in these zones, particularly in the MZ, in which the number of plays under pressure (892 cases) was significantly higher than that in the DZ (147 cases); by contrast, 2) in the AZ where goal-scoring or breakthrough play is prioritized, it may not be effective for non-ball carriers to attempt to receive a pass near the ball carrier while forming a DS. This is an objective indicator, as shown by Japan's top-level teams, and we believe that it can serve as a standard for analyzing and teaching support play in training and games.

5. Summary

This study, using three matches between the top four teams in the JL 2019 season examined the relationship between player positioning and zone in group support play by classifying DS by the number of players who can receive the ball in DS surrounding the first DF under pressure and by clarifying the occurrence rate of each DS in each zone. The results of this study can be summarized as follows:

- Significantly higher occurrences of Offensive Advantage DS-2 and Offensive Advantage DS-3 were observed in the DZ (23.1% and 16.3%, respectively) and the MZ (25.7% and 14.9%, respectively) than in the AZ (14.8% and 5.6%, respectively).
- A significantly higher occurrence of Defensive Advantage DS-0 was observed in the AZ (3.5%) than in the MZ (1.2%).
- A significantly lower occurrence of Around Defender DS was observed in the AZ (35.2%) than in the DZ (49.7%) and the MZ (49.6%).

These findings suggest that the effectiveness of group coordinated support play varies by zone, and that in the DZ and the MZ it is effective for players close to the ball carrier to take a DS position to help the ball carrier and make coordinated ball receiving moves. However, this type of play may not be effective in the AZ, where the priority is to play for a goal or a breakthrough. Thus, this research provides objective and practical indicators on support play in groups and offers valuable suggestions for assessing and teaching cooperative play in training and games. In the future, it will be necessary to accumulate practical studies on cooperative play, such as the characteristics of coordinated movement in each zone, and the factors that affect the distance of support play.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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