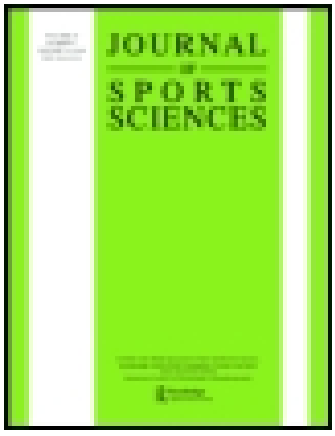

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Effectiveness during ball screens in elite basketball games

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Abstract
Ball screens are one of the most frequently used tactical behaviour in elite basketball games. The aim of the present study was to identify their predictors of success related to time, space, players, and tasks performed. The sample was composed of 818 ball screens corresponding to 20 close games (mean differences in score of 3.1 ± 0.8 points) randomly selected from the playoff games of the Spanish Basketball League (2008–2011). Classification tree analysis (CHAID) was used to analyse which variable or combination of variables, better predicts effectiveness during ball screens. The main results allowed identifying interactions with dribbler actions after the screen and the orientation of the screen on the ball. The results showed no interaction with game quarter and quarter minute temporal-related variables in both analyses. The present findings allow improving coaches' strategic plans that involve selecting the most appropriate offensive approach when performing ball screens.

Keywords: *performance analysis, performance indicators, environmental-related variables, classification tree analysis*

Introduction

Performance analysis is used in team sports to describe the technical, tactical and strategic behaviours during training or competitions in order to measure and understand performance (Drust, 2010). Available research aims to obtain complex and dynamic information of game behaviours, gathered under a well-described environment (Grehaigne & Godbuout, 2013; McGarry, 2009; McGarry, Anderson, Wallace, Hughes, & Franks, 2002). In fact, tactical modelling allows describing the game behaviours considering the cooperation and opposition relationships from a complex perspective where team members try to facilitate the movement of the ball, to score points or to prevent the opposition from scoring (Garganta, 2009; McGarry, 2009). In team sports, such as basketball, some tactical behaviours are considered more important than others. In basketball, success is highly related with the training process and coaches' decisions, particularly when designing, training and selecting the most appropriate offensive or defensive plays. Specifically, results from previous studies revealed that ball screens are one of the most important finishing actions during team-tactical plays. Firstly, Remmert (2003) analysed 60 games of men's and women's German National League and International elite basketball (i.e., men and women games of European League, WNBA, NBA and NCAA) through systematic observation, and the author described the group-tactical offensive behaviours and the effectiveness of these tactics. The results showed that ball screens are one of the most important finishing actions during team-tactical plays, consisting of 12.7% of group tactical actions for a mean of 1.08 points scored per ball possession (Remmert, 2003). More recently, Karipidis, Mavridis, Tsamourtzis, and Rokka (2010) analysed 80 European Tournaments games and found that 40% of set offenses involved using ball screens. Also, Lamas et al. (2011) found that ball screen actions were used in 34.8% in the Men's World Basketball Championship (2002, Indianapolis, USA). Accordingly, Gómez, Lorenzo, Ibañez, and Sampaio (2013) analysed a large sample of ball

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possessions ($n = 7234$) and reported higher frequency of ball screens during the first 5 min (50.0% and 18.5%, for men and women's, respectively), the middle 30 min (40.6% and 20.6%, for men and women's, respectively), and last 5 min of games (36.7% and 19.1%, for men and women's, respectively).

Although very informative, these studies did not account for teams' and players' behaviours from a tactical modelling perspective. Hollins (2003) defined the ball screen as a legal block set by an offensive player on the side or behind a defender in order to free a teammate to shoot or receive a pass. The key to the screen on the ball effectiveness is not how fast the offensive player goes off the screen, but how well you read what the defence is doing against the screen (Hollins, 2003). In particular, the ball screens involve at least two players that have their own responsibilities; the screener picks an area and gets stationary while the dribbler waits until the screener has set the pick. Then he sets up his defender by dribbling away from where he actually wants to go. Therefore, both offensive players have to read whether the defence follows, deny or close the gap (Hollins, 2003). The importance of studying the players' behaviours during ball screens is relevant for playing effectively, particularly when creating time and space advantage over the opponents (Garganta, 2009; Grehaigne & Godbuout, 2013). Under this rationale, the coaches have to monitor the key variables that determine the ball screens effectiveness in order to optimise drill designing and practice for an advantageous preparation.

Within the team-tactical structure of ball screens, there are a wide variety of action patterns that end successfully. Remmert (2003) detected an increment on screen effectiveness when the shot was the following action, the dribbler drives to the basket or passes an open teammate, and the screener rolls to the basket (Remmert, 2003). Also, Karipidis et al. (2010) found that the most tactical behaviour of cooperation with ball screen was pick and roll (i.e., setting a screen and rolling to the basket). Mexas, Tsitskaris, Kyriakou, and Garefis (2005) suggested that team-tactical behaviours should seek for the most effective shot selection, and consequently it depends on variables such as defensive actions, distance from the basket or players involved. Therefore, the ball screens can be considered as key determinants of success during a basketball ball possession and should be understood as game functional units (Garganta, 2009).

The environmental-related variables have also an important effect on ball possession effectiveness and consequently on team-tactical behaviours. Specifically, Garganta (2009) suggested the importance of tactical performance indicators such as time, space, players and task variables, as determinants of different ways of cooperation and opposition, information usage and organisation (Grehaigne & Godbuout, 2013). For example, game quarter, quarter minute, or ball possession remaining time constraint the teams' strategies and tactics during the games and have a direct effect on performance (Gómez, Lago, & Pollard, 2013). From a competition-preparation perspective, team sports where constraints change considerably across games require a better adaptation of practice environments that control for time, space, players, and task constraints (Eccles, Ward, & Woodman, 2009). However, available literature on this topic is scarce, particularly in exploring team-tactical structures and effectiveness regarding time, space, players, and task performance indicators (Gómez, Lorenzo, et al., 2013; Remmert, 2003). Recently, Gómez, Lorenzo, et al. (2013) identified that ball possession effectiveness varied according to gender, game period and tactical indicators. More specifically men's teams showed interactions between ball possession characteristics and effectiveness such as the time (i.e., game period and possession duration), space (i.e., starting and ending zones), players (i.e., starting and ending players, or number of players involved), and task (i.e., screens used or defensive systems) related variables. These results enhance the importance of players' interactions during basketball ball possession that may influence the strategic and tactical approaches to score, particularly the team-tactical behaviours, such as screens on the ball (Remmert, 2003). Therefore, there is interest in identifying and describing the variables that may have an effect on ball screens, as available research developed a descriptive point of view without exploring the interactive situational effects (Karipidis et al., 2010; Lamas et al., 2011). This approach may allow for a better understanding about the interaction generated by teammates and opponents when analysing time (i.e., quarter minute, time possession remaining or game quarter), space (i.e., the zone and orientation of ball screen), players (i.e., the screener and dribbler playing position) and task-related variables (i.e., the type of screen, the screener's and dribbler's actions, or the screener's and dribbler's defender actions).

Therefore, the aim of the present study was to identify the predictors of success in ball screens related to time, space, players and tasks performed. We hypothesised that group-tactical behaviours during ball screens are dependent on time, space, players, and task performance indicators that lead to determine the ball screen effectiveness.

Method

Sample

The local Institutional Review Board approved this study to investigate the effectiveness during ball

screens in Elite basketball. The sample was composed of 818 screens on the ball from set offense situations when the opponents used a man-to-man defence, corresponding to 20 close games from the playoffs of the Spanish professional basketball League (2008–2009 to 2010–2011 seasons). These games were selected after using a *k*-means cluster analysis to differentiate all games in three groups according to the final differences in points: close games, mean differences in score of 3.6 ± 1.8 points (mean ± s), range 1–6 points, n = 20; balanced games, 9.5 ± 1.6 points, range 7–12 points, n = 15; and unbalanced games 17.1 ± 3.5 points, range 13–21 points, n = 23.

Procedure

The games were analysed through systematic observation using video analysis software (Kinovea, version 0.8.15, www.kinovea.org). Two experienced observers were trained for this task, graduated in Sports Sciences with a minimum of 5 years experience as basketball coaches. In order to prevent any learning effect, after a 3-week period, each observer repeated the observation of one randomly selected game. The weighted *Kappa* correlation coefficients were used to assess inter-observer and intra-observer reliability. The obtained results showed very good kappa values for both observations (observer A = 0.84 and 0.81; and observer B = 0.80 and 0.82) for intra-observer reliability, while inter-observer reliability showed good and very good values (range = 0.79–0.87) (Altman, 1991).

Data notation

The ball screens' effectiveness was transformed into a dichotomous dependent variable (Gómez, Lorenzo, et al., 2013): successful (when the offensive team scored a 2 or a 3-point field-goal after: the dribbler drives to the basket, passes an open teammate or gives and goes to the basket, and when the screener or the dribbler received a foul, including foul shot or a foul received immediately after the screen), and unsuccessful (when the offensive players missed a 2 or 3-point field-goal, received a block shot, committed a foul, the dribbler passed an outside player that does not shot, defensive trap, interceptions, made a turnover or made any other rule violation).

The independent variables were related to time, space, player, and task dimensions (Gómez, Lorenzo, et al., 2013; Marcelino, Mesquita, & Sampaio, 2011). Time related effects were controlled by measuring quarter half (0–5 or 6–10 min), time possession remaining (three periods were defined according to a *k*-mean cluster analysis: 24–16, 16–8 or 8–0 s to shot), and game quarter (first, second, third or fourth quarter).

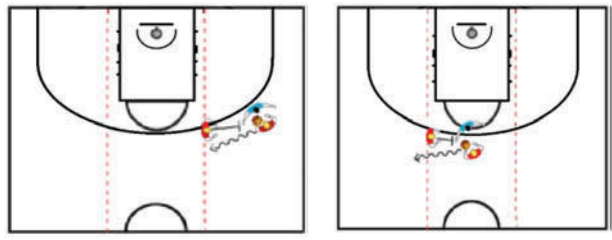

Figure 1. Zone where the ball screen was set.

Space related variables were defined as follows: (i) the zone (see Figure 1) where the ball screen was set (central and lateral zones), and (ii) the orientation of the screen, defined as the trajectory developed by the dribbler when is screened by the screener (to lateral zone, to the baseline, or to central zone).

The player related variables were defined by 5 playing positions (guards, point-guard, forward, power-forward, and centre) (Dežman, Trninić, & Dizdar, 2001), and then two variables were considered: (i) the screener playing position (centre, forward or power-forward, only these players were observed as screener player during the 818 ball screens studied), and (ii) the dribbler playing position (Vincenzi, 2003) as follows: outside players: point guard, shooting guard and forward; and inside players: power-forward and centre.

The task related variables were established according to Remmert's (2003) definitions (external validity by consistent judgments of basketball experts) and included (i) the screener's actions after setting the screen (rolls away to the basket, rolls to the basket, repick, set another screen, is screened or passive movements); (ii) the dribbler's actions after the screen (drives to the basket, drives to the basket and assists, gives and goes, passes an open teammate, triangle passes, throws a field-goal or drives away to the basket); (iii) defensive actions of the screener's defender (vertical flash, horizontal flash, push, open, deny, 2 on 1 double team, or switch); (iv) defensive actions of the dribbler's defender (follows the dribbler, sliding through, goes under the screen, deny, 2 on 1 double team or switch); and (v) screen type (side screen, hand to hand, or back screen) (for specific details see supplemental online material).

Statistical analysis

Firstly, a descriptive and inferential analysis was performed using crosstabs. The Pearson's Chi-square test was used to analyse the effects between ball screens' effectiveness and the variables related to

time, space, players, and task dimensions. The data observations were considered as independent sampling units, assuming that behaviours during ball screens configure unique interactions between combinations of players and opponents regulated by unpredictable task and environment-related variables (Duarte, Araújo, Correia, & Davids, 2012; Vilar, Araujo, Davids, & Travassos, 2012). The quality of opposition was disregarded because differences in ability between teams competing in elite professionally close games are unlikely to be large (Lupo, Condelo, Capranica, & Tessitore, 2014). Also, the approach to study ball screens related to time, space, players, and task dimensions would be conflicting with an overall variable such as quality of opposition (Gilovich, Valone, & Tversky, 1985; Remmert, 2003). Effect sizes (*ES*) were calculated using the Cramer's *V* test and their interpretation was based on the following criteria: 0.10 = small effect, 0.30 = medium effect, and 0.50 = large effect (Volker, 2006).

Secondly, a classification tree analysis was used to determine ball screens' classification according to environmental variables and effectiveness. This technique allows splitting the sample into different subgroups (nodes) based on the impact of predictions (i.e., temporal, zone, players and task related variables) on the effectiveness when setting a ball screen. Also, this analysis provides visual information from the impact of each independent variable in a hierarchical tree model (Biggs, Ville, & Suen, 1991; Schnell, Mayer, Diehl, Zipfel, & Thiel, 2014). The algorithm used was the exhaustive CHAID (Chi-squared automatic Interaction detection), appropriate to nominal dependent and independent variables. Chi-square test identifies the relationships between independent variables through completing three steps on each node of the root (merging, splitting and stopping) to find the predictors that exert the most influence on the dependent variable. The exhaustive CHAID examines all possible splits for each predictor and the merging step increases the search procedure to merge any similar pair until only single pair remains (Schnell et al., 2014).

The following statistical specifications were considered: (i) significant level was set to $P < 0.05$; (ii) Pearson's Chi-square was used to detect the relationships between independent variables; (iii) the maximum number of iterations were 100; (iv) the minimum change in expected cell frequencies is 0.001; (v) the significant values adjustment was done using the Bonferroni method; and (vi) the tree has a maximum of 3 levels. Finally, the risk of misclassification was calculated as a measure of the reliability of the model (Schnell et al., 2014). Both statistical analyses were performed using IBM SPSS statistics for Windows, version 20.0 (Armonk, NY: IBM. Corp.).

Despite the consideration that observations were treated as independent sampling units (Duarte et al., 2012; Vilar et al., 2012), using ball screens situations performed by the same teams may also reflect that the data present a certain degree of dependency. Further research using similar nested design should consider also using multilevel modelling to overcome this issue (Heck, Thomas, & Tabata, 2014; Nevill, Webb, & Watts, 2013).

Results

The sample distribution of each time, space and player related variable for basketball ball screens is presented in Table I (percentage and case numbers). The time related variables showed that only time possession remaining was significant and greater effectiveness was identified when the team had 8 to 0 s to shoot (17.7% compared to 8.9%). Conversely, lower effectiveness was identified when there were 24 to 16 s remaining to shoot (13.8% compared to 21.2%). No significant relationships were identified between ball screen effectiveness neither for quarter time nor for game quarter.

The results for space related variables showed that the orientation was significantly related to effectiveness, particularly the lateral screen showed lower success (28.5% compared to 37.3%) in contrast with top screen (56.7% compared to 49.9%) and baseline screen (14.8% compared to 12.9%). The screen on the ball zone was not significantly associated with effectiveness. The player related variables showed no significant relationships with ball screen effectiveness for screener or dribbler players.

Table II shows the sample distribution of each task related variable for basketball ball screens (percentage and case numbers). The results showed that type of ball screen was significantly related with effectiveness, being the hand-to-hand (10.0% compared to 4.8%) and back screen (3.2% compared to 1.5%) the most effective options. However, the side screen reduced the effectiveness (86.8% compared to 93.7%). Also, the screener's and dribbler's action after the screen were significantly related with effectiveness. The screener's action that reduced effectiveness was repick (0.8% compared to 7.0%) and the action that increased the ball screen effectiveness was roll to the basket (64.1% compared to 61.2%). The dribbler's actions that increased effectiveness were drives to the basket (26.1% compared to 5.1%) and field-goal (22.7% compared to 0.7%). On the contrary, the actions that decreased effectiveness were passes to an open teammate (12.9% compared to 39.4%) and drives away to the basket (1.6% compared to 20.3%). Lastly, the dribbler's defender action was significantly related with effectiveness, higher values were identified when the dribbler's

Table I. Frequency distribution (%) of screen on the ball effectiveness according to performance indicators (Crosstab Command: Pearson's Chi-square, degrees of freedom, significance, expected frequency distribution, and effect size).

	Unsuccessful $n = 459$		Successful $n = 379$						
Performance indicators	%	*n*	%	*n*	χ^2	df	*P*	*EFD*	*ES*
Time related indicators									
Quarter minute									
0–5	52.9	243	49.9	189	0.785	1	.376	183.6	0.03
5–10	47.1	216	50.1	190					
Time possession remaining									
24–16	38.8	178	30.6	116	16.286	2	.001**	48.8	0.14
16–8	52.3	240	51.7	196					
8–0	8.9	41	17.7	67					
Game quarter									
First	28.8	132	24.3	92	2.934	3	.402	83.7	0.06
Second	23.5	108	27.2	103					
Third	25.3	116	26.9	102					
Fourth	22.4	103	21.6	82					
Space related indicators									
Zone									
Central	53.2	244	46.7	177	3.462	1	.063	188.6	0.06
Lateral	46.8	215	53.3	202					
Orientation									
Top screen	49.9	229	56.7	215	7.174	2	.028*	52.1	0.61
Lateral screen	37.3	171	28.5	108					
Baseline screen	12.9	59	14.8	56					
Player related indicators									
Screener									
Centre	62.5	287	67.5	256	2.565	2	.277	9.95	0.06
Power forward	34.4	158	30.3	115					
Outside player	3.1	14	2.1	8					
Dribbler									
Outside player	99.6	457	98.9	375	1.121	1	.258	2.71†	0.04
Inside player	0.4	2	1.1	4					

Note: * $P < 0.05$; ** $P < 0.01$; EFD = expected frequency distribution; † When EFD was below 5 or the variable includes values below 1% the Fisher's exact test was applied.

defender follows the dribbler (47.5% compared to 43.8%), does a switch (18.7% compared to 13.5%), or deny (2.9% compared to 1.5%). When he goes under the screen (1.6% compared to 4.4%), and performs a 2 on 1 double team (0.5 compared to 1.1) the ball screens tended to be unsuccessful.

The classification tree analysis included all the time, space, player and task related variables in the statistical model. The results showed only two significant influencing factors on ball screen effectiveness (two-stage tree). The following factors led to 7 nodes (6 final nodes) of contrasting groups of ball screens with different effectiveness, mainly established by dribbler's action after the screen (level 1) and orientation of the ball screens (level 2). Figure 2 shows the categories for predictor variable (effectiveness) and also the 7 nodes defined by the classification tree analysis.

Level 1 (root node) is split by the dribbler's action after the screen. High effectiveness was achieved when the dribbler drives to the basket (node 1: 79.2% successful; $n = 99$) and shots a 2 or 3-point field-goal (node 5: 96.9% successful; $n = 86$). The effectiveness was low when the dribbler drives away to the basket (node 3: 93.9% unsuccessful; $n = 93$), and passes an open teammate (node 4: 78.7% successful; $n = 181$).

At level 2, there were lower differences in effectiveness when the dribbler drives to the basket and passes, gives and goes to the basket and does a triangle pass (node 2: 52.9% unsuccessful and 47.1% successful; $n = 156$ and 139, respectively). The classification tree analysis identified significant differences with predictor variables when the ball screens' orientation was included. The effectiveness was increased when the orientation of the screener was baseline screen (node 6: 53.0% successful; $n = 105$), and decreased when the orientation of the screener was to lateral zone (node 7: 64.9% unsuccessful; $n = 63$).This classification tree model enabled explaining 74.8% of total variance.

Discussion

The aim of this study was to identify the predictors of success related to time, space, players, and tasks

Table II. Frequency distribution (%) of screen on the ball effectiveness according to performance indicators (Crosstab Command: Pearson's Chi-square, degrees of freedom, significance, expected frequency distribution, and effect size).

	Unsuccessful n = 459		Successful n = 379						
Performance indicators	%	n	%	n	χ^2	df	P	*EFD*	*ES*
Task related indicators									
Type									
Side screen	93.7	430	86.8	329	11.490	2	.003*	8.59	0.12
Hand to hand	4.8	22	10.0	38					
Back screen	1.5	7	3.2	12					
Screener's action after setting the screen									
Rolls away to the basket	25.7	118	28.5	108	22.917	5	.001*	3.17†	0.16
Rolls to the basket	61.2	281	64.1	243					
Repick	7.0	32	0.8	3					
Set another screen	4.4	20	4.7	18					
Is screened	0.9	4	1.1	4					
Passive movements	0.9	4	0.8	3					
Dribbler's action after the screen									
Drives to the basket	5.7	26	26.1	99	268.185	6	.001*	15.4†	0.57
Drives to the basket and assists	10.9	50	11.9	45					
Gives and goes to the basket	19.4	89	20.3	77					
Passes an open teammate	39.4	181	12.9	49					
Triangle passes	3.7	17	4.5	17					
Field-goal	0.7	3	22.7	86					
Drives away to the basket	20.3	93	1.6	6					
Screener's defender									
Vertical flash	19.5	87	14.3	53	9.863	6	.107	0.45†	0.11
Horizontal flash	35.8	160	38.8	144					
Push	3.1	14	3.0	11					
Open	27.7	124	25.1	93					
Deny	0.0	0	0.3	1					
2 on 1 double team	1.1	5	0.5	2					
Switch	12.8	57	18.1	67					
Dribbler's defender									
Follows the dribbler	43.8	201	47.5	180	27.887	6	.001*	3.17†	0.18
Sliding through	18.5	85	21.1	80					
Goes under the screen	4.4	20	1.6	6					
Deny	1.5	7	2.9	11					
2 on 1 double team	1.1	5	0.5	2					
Switch	13.5	62	18.7	71					

Note: * $P < 0.01$; EFD = expected frequency distribution; † When EFD was below 5 or the variable includes values below 1% the Fisher's exact test was applied.

during ball screens in elite basketball. The main results allowed identifying interactions with time possession remaining, the orientation of the ball screen, the type of screen, the screener's and dribbler's actions after the screen, and the dribbler's defender actions. These results allow supporting the hypothesis that group-tactical behaviours during ball screens are dependent on time, space, players, and task performance indicators.

Time related variables

The time remaining in ball possession affected ball screen effectiveness, mainly during the 8 final seconds. In fact, at the end of ball possession the defenders are more disorganised collectively and probably with more fatigue (Bar-Eli, & Tractinsky, 2000; Bourbousson, Sève, & McGarry, 2010). Therefore, ball screens are likely to be more effective. According to Remmert (2003) the use of direct screens to allow for better shooting positions and following actions, provide extra space and time for offensive players. This task is important during final seconds of ball possessions, particularly by using collective tactical decisions that enable creating optimal space-time field-goal opportunities inside the paint or better field-goal positions without defensive pressure (Gómez, Lorenzo, et al., 2013; Mavridis, Laios, Taxildaris, & Tsiskaris, 2003).

Space related variables

The analysis of space related variables allowed identifying the screen orientation as contributor to

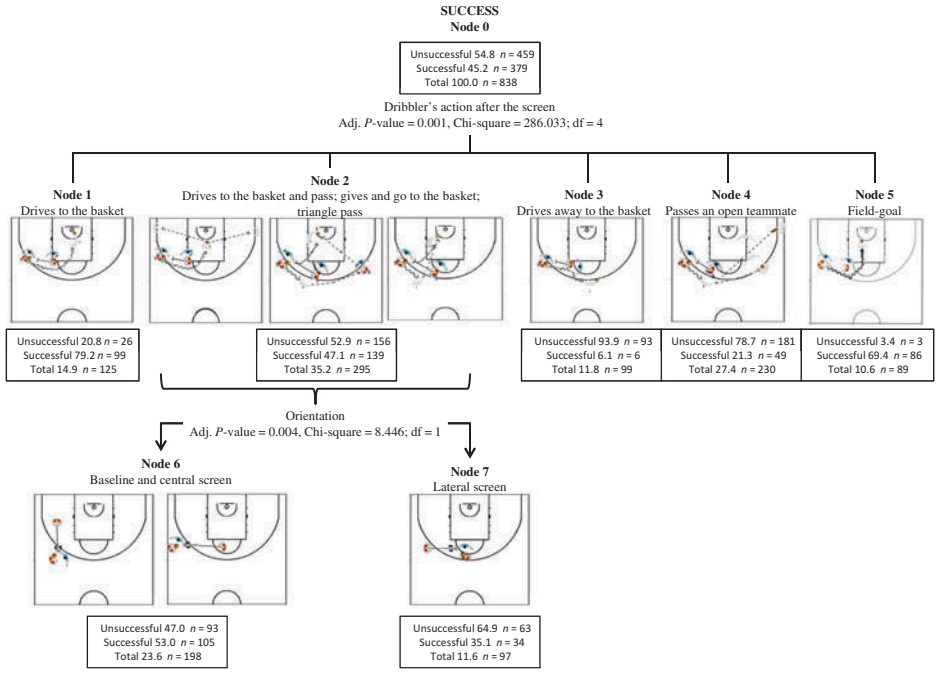

Figure 2. Classification tree analysis of ball screen effectiveness.

effectiveness. There was lower effectiveness when the screener sets a ball screen from central to lateral zones and higher effectiveness when the screen was set from lateral to central zones or to the baseline. The lateral positions reduce the offensive possibilities of action and allow the defenders' anticipation when denied or guide the ball screen close to the sideline. According to Lamas et al. (2011) the ball screens can be set in different court zones to create space and potential scoring situations for the screener and the dribbler. Thus, when the screen was orientated to the central zone or to the baseline it generates more space and indeed more possibilities for triangle passes, give and go actions or passes to open teammates (Hollins, 2003; Ortega, Cárdenas, Sainz De Baranda, & Palao, 2006; Remmert, 2003).

Players related variables

One intriguing result was the absence of significant effects between players' related variables and ball screen effectiveness. These results highlight the idea that ball screen is a team-tactical behaviour quite pre-determined by the coaches during elite basketball close games, thus, is developed by the players who act in the same playing positions, both the screener and the dribbler. In fact, the outside and inside players' weight and height characteristics are very different (Mavridis et al., 2003; Sampaio, Janeira, Ibáñez, & Lorenzo, 2006) and, for example, it is more appropriate to use inside players for screening (Vincenzi, 2003). Therefore, the practice drills are specific, for example, centre players should focus on technical and tactical abilities when setting the ball screen (e.g., shooting from middle and outside distances and screening the dribbler's defender) (Remmert, 2003).

Task related variables

There were four task-related variables significantly associated with ball screen effectiveness. The back screens and hand to hand screens obtained higher effectiveness than the lateral screens. In fact, lateral screens are very frequent in elite basketball and it is likely that defenders are more prepared against this tactical resource. Conversely, the hand to hand screens are harder to anticipate because both offensive players develop the screen dynamically, reducing the space for stealing the ball or intercepting the pass. Also, the dribbler is an outside player that has good shooting and dribbling abilities to finish the screen continuation (Sampaio et al., 2006; Trninić & Dizdar, 2000).

The screeners' actions after the screen are related to less effectiveness when doing a repick. This tactical behaviour is used to create more space and a new possibility for the dribbler, but it generally occurs when the defender follows the dribbler, constraining the offensive options. Conversely, the screeners' higher effectiveness following action to the screen is continuing to the basket. Rolling to the basket is a common action for defenders to stop, but when the screener rolls away from the basket it generates more space and increases the difficulty for defenders. These results are in accordance with those found by Wang, Liu, and Moffit

(2009) that described the importance of drives and rolls to the basket as two of the most offensive tactics used during screens. In fact, Karipidis et al. (2010) identified the pick and roll as the most common way of cooperation during ball screens. As these actions are widely trained by teams, the coaches should improve the training variability and task constraints and also "unorthodox" screeners' following actions that generate more space for shooting or passing to the screener in an easier field-goal position (Lamas et al., 2011; Remmert, 2003).

The dribblers' actions after the screen increased the effectiveness when driving to the basket or shooting after dribble, as suggested earlier (Karipidis et al., 2010). Conversely, the dribbler obtained lower effectiveness when passing to an open teammate or driving away to the basket. These reflect the influence of good anticipation for creating more space and an advantage for finishing the ball possession (Gómez, Lorenzo, et al., 2013; Remmert, 2003). The influence of the dribblers' defender actions significantly increased the effectiveness when switched or denied and decreased the effectiveness when following the dribbler or going under the screen. Screen effectiveness is determined by how the dribbler perceives what the defender is doing against the screen (i.e., bump back for a shot or square up for a one on one); and how well the screener sets the screen and set up the dribblers' defender away from the dribbler (Hollins, 2003). Both situations create a mismatch and then a defensive unbalance that allow an offensive advantage for the dribbler (i.e., faster than a higher defender with slow lateral defensive movements) and the screener (i.e., that rolls to the basket and have an advantage near the basket with a small defender). When the dribbler chooses to deny, it generates more offensive possibilities, and more unpredictability for the defender, with better following actions for both the dribbler and the screener (Lamas et al., 2011).

Classification tree analysis

The results from the classification tree analysis identified the dribblers' action after the screen and the orientation of the screen as the most important predictors of ball screen effectiveness. The coaches and performance analysts should pay attention to screens set to baseline zone or from lateral to central zone that involve triangle passes, gives and go to the basket or drives to the basket and passes to open teammates. On the one hand, these team-tactical behaviours point out the importance of defensive responses that force the dribblers' defender to anticipate his actions, when the dribbler goes off the screen and then generates more options for dribblers' penetration and passing. And on the other hand, from an offensive perspective these team-tactical behaviours allow for a better perception of the screen and the defenders actions, and likely generate more options for shooting and assisting open teammates. The success ball screens depend directly on how the offensive players set the screen, perceive and anticipate the defensive actions (Hollins, 2003).

According to Eccles et al. (2009) there exists an importance of transfer from practice to competition that is dependent on the extent to which a practice environment is close similar to those specific constraints within competition environment. Therefore, the competition-specific constraints should be addressed in order to appropriately account for such constraints through the selection of adequate training tasks that simulate these events in competitive games. Then, the identified trends provide important information for modelling high-level performances during ball screens, therefore basketball coaches should prepare the training of ball screen tasks that promote the sport intelligence and the quality of decisions during close games and stressful situations, to improve the players' performance according to these specific game constraints.

Further research is needed to examine this topic using games from other leagues and, for example, identifying how the different defensive and offensive team formations affect these variables. In addition, group-tactical behaviours such as out-of-ball screens, multiple screen, or perimeter and post actions are also candidate actions for study.

Supplemental data

Supplemental data for this article can be accessed here.

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