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Cues for anticipation ball direction in penalty kicks in Soccer

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Review of literature

Goalkeeper's strategies play an important role on penalty kicks. They must initiate movement before the striker makes ball contact. Expert goalkeepers are more accurate at predicting shot direction than novices. (Williams et al.1998 research quarterly for exercise and sport, 69,111-128). (A. lees, k .David and w. g. Murphy, pp.48-492, London; E&FN spon) identified two types of goalkeeper's strategies. In the first (late strategies) which goalkeepers initiated their dive at kicker ball contact or immediately afterwards. The second (early strategy), goalkeepers dived before kicker ball contact. On the other hand, kickers are divided into either, keeper-independent or keeper-dependent approaches. (et al John van Derkamd 2006). In the keeper-independent strategies, the shooter select a target location in advance and disregard the goalkeeper actions during run-up, while in the keeper-dependent, the shooter makes a decision resting on goalkeepers movements during run-up. The study used 10 intermediate-level soccer players shot at one of two visually specified targets to the write and left side of the goal. Results showed that penalty-taking performance was apt to be less than perfect in the keeper-dependent strategy condition. A decrease in the time available to alter kick direction resulted in higher risk of not only an incorrect but also inaccurate shot placement due to insufficient time to modify the kicking action. The study suggested that trying to take into account the goalkeeper action might seriously impede the successful conversion of the penalty kick. But, when is kicker can alter his kick safely? (Morya, E.,Ranvaud,R.&pinhairo,W.M. 2003) suggested that kicker will only approach perfect performance if the goalkeeper commits himself to on a side more than 400 ms before ball contact.

Another study (E.morya, h. Big atao,A. lees and R. Ranvaud 2003) tried to identify common factors that might be key to performance from both, the kickers and goalkeepers point of view. They analyzed 75 penalty kicks digitized. Results showed that speed of ball was 32ms, and goalkeepers dived on contact or later. The study confirmed earlier studies

which include diving relatively late give goalkeepers a better chance of diving in the correct direction.

The important resources of information used by expert goalkeepers to save the penalty kicks did not reach common agreements. Some researchers fined the position of the hips, kicking leg trunk just before and during

contact to be important (eg.tyldesly et al.1982: Williams and Burwitz, 1993), while others argue that the orientation of the non-kicking foot is the key (eg.franks and hamvey, 1997).

(Hawson,h. james,n. and mellalieu,s.) Examined soccer goalkeeper's use of advance cues when attempting to save a shot, from either a penalty or run. Subjects were 10 expert and 10 novice goalkeepers. Video camera was used to compile video of 48 clips of different shots (24 penalties and 24runs). Results revealed that experts were significantly better at anticipating shot direction than novices. Type of shot, type of body part, and head region are the sassiest cues to anticipate the shot direction, while the leg and the ball region are the most difficult cues. The study suggested on focusing on the leg and hip regions body. Besides, goalkeeper should avoided focusing the head, thus preventing him from being deceived into diving the wrong way when making save.

Another study embraced new technology in an attempt to determined key difference between experts and novice soccer goalkeepers (Geert, 2002). This study is different than (Savelsbergh and Van der kamp 200) in measuring visual information. Visual information was picked up in continues rather than discrete fashion and the response is not measured by a button press, but by mean of joystick linked to a potentiometer to insure continuous data sampling. This procedure allows correction to be made to the response in an ongoing manner as the flow of information changes across early and late period in penalty kick. Results found that expert goalkeepers make corrective movements nearer to foot-ball contact later than novice one. Moreover, experts used a less exhaustive search strategy involving fewer fixation of longer duration than their novice counterparts. The novice spend longer fixation on trunk, arm, and hip region, whereas the experts preferred to fixate their gaze on the kicking leg, non-kicking leg, and the ball areas.

Most errors (62%) were associated with incorrect judgment about height: only (26%) of errors were due to incorrect prediction about which side the goal the ball was placed. (McMorist,T.Copman,R.Corcoran,D.Saunders,G. and potters,S. 1993).

The closest study to our study is by Franks and Harvey (Franks,i.m.& Harvey, t. 1997). Their goal was to identify the sources of advanced information that can be used by goalkeeper to stop a penalty kick. The study analyzed the penalty kicks taken in world cup tournaments (1982-1994). Results showed that the placement of non-kicking foot was the earliest reliable predictor of shot direction, approximately 200-2500 ms before ball contact, and probably earlier. It must also be taken into account that the adjustments in the kicking movement do not follow directly after pick up of critical information specifying the alternation. So decision to alter the direction of the shot ought to be made at least 300-500 ms before ball contact to prevent the degradation of penalty kick performance. Delaying the decision may lead to either a failure to place the ball to the side of the goal opposite to the direction of the goalkeepers dive, or a decrement in the special accuracy and speed of the ball.

This study will continuo the earlier researches and pinpoint on the direction of the non-kicking foot. It will take further step toward testifying the role of non-kicking foot in experimental design.

The purpose of this study is to give goalkeeper an early clue to respond effectively. The study required two experiments to achieve the aim.

Experiment 1

The aim of this experiment was to decide whether the ball goes along with the longitudinal line of the supporting foot.

Subjects were three elite soccer players aged 18-22. They were asked to execute two penalty kicks. Every kick goes to one corner of the goal. They have no idea about the experiment.

Three cameras were used to film the six kicks. One was located 5m behind the center of the goal. It focused on the movements of the feet. A second camera was located 7m behind the goal to record the pathway of the ball. The third camera located 3m to the side of the kicker to measure the duration time between supporting the foot and the beginning of ball movement. The speed of all cameras is 25 photos per sec.

Procedures

All films were analyzed using the (AutoCAD and DARTFISH programs) to gain the following data.

1. The angle between the longitudinal line of the supporting foot and the vertical line between the kicking spot and the center of the goal for all kicks.

2. The angle of the ball's pathway for all kicks referring to the center of the goal.
3. The time between kicking and reaching the goal.
4. The time between the supporting foot and kicking the ball.

Results

Table (1) shows the angles of the supporting foot compared to the angles of the ball's direction. The data shows that all directions go along with the direction of the supporting foot with minimum deviation. They all performed in the same manner.

Table (1)- Shows the angles of the supporting foot compared to the angles of the ball's direction.

variables	Write kick		Left kick24◦	
	Angle of ball	Angle of foot	Angle of ball	Angle of foot
Player -1-	15◦	17◦	21◦	45◦
Player -2-	10◦	21◦	17◦	29◦
Player -3-	25◦	46◦	24◦	32◦

Table -2- shows speed of kicks and time between supporting foot and kick

speeds	Speed of the ball	Time between foot rest and kick
Player -1-	110 KPH	140 mc.
Player -2-	100 KPH	160 mc.
Player -3-	100 KPH	160 mc.

If the goalkeeper takes into account the position of the supporting foot, he will have an extra time (160mc) to think, decide and act.

Experiment -2-

After analyzing the kicking movement from kinesiology point of view the study ran a second step.

The aim of this experiment was to give the goalkeeper an early signal of ball direction. Thus, he will have more time to predict, think and act properly. The study hypothesized that concentrating on the supporting foot gives an early indicator about ball direction in penalty kick.

Procedures

The subjects of the second experiment were 25 soccer players. Twenty elite players who represent the first class club in were elite Iraqi football league.

The other five players were first class goalkeepers. All subjects have more than five years experience.

Every goalkeeper received twenty penalty kicks from soccer players. The total kicks were 100. The goalkeeper was changed after every kick. The study counted the errors. If the goalkeeper goes to the wrong direction he receives two points. If he goes to the same direction but failed to catch it; he receives one point. But if he catches the ball he will receive zero.

Then (next day) goalkeepers were instructed to concentrate on the supporting foot and draw a line a long with longitudinal axis of the foot and prepare to act accordingly.

Goalkeepers received another 100 kicks from the same players under the same condition.

For statistical analysis; the study used the mean of errors for all goal- keepers. Also the study used standard deviation and t-test .

Results

Results showed that the mean of the pre test was twenty five errors out of forty with 2.13 SD. The mean of the post test was sixteen SD=2.13. t – test between pre and post test=14.2 which showed significant differences.(see table 3).

Pre-test showed that there was %45of the kicks were misdirected by the goalkeepers. Post-test (which came after constructing goal keepers to concentrate on direction of supporting foot) showed that there was only%12 of the kicks were misdirected. (Table-4).

Table (3)- Shows the M, SD, & t test between pre and post test

Pre test		Post test		t.test	Critical values
Mean	SD	mean	SD		
25	2.13	16	2.1	14.2	2.101

Degree of freedom = 19. Confidence = 95% & the

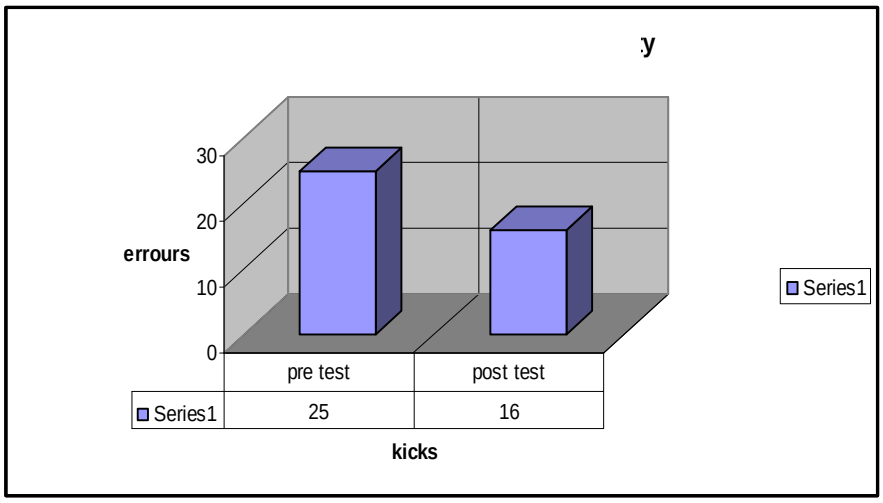


Figure 1 shows no. Of errors out of forty

Table (4)- Shows comparison between pre and post test in misdirection

tests	Kicks NO.	misdirection
Pre-test	100	45
Post-test	100	12

Discussion

Results confirm the hypothesis of the study. In the post test, goalkeepers responded more properly. They showed less misdirection in their responses. Imagine if they had enough time to practice on this new indicator. From this point of view goalkeepers have more time especially during the back swing of players kicking leg. This adds chance to the goalkeepers

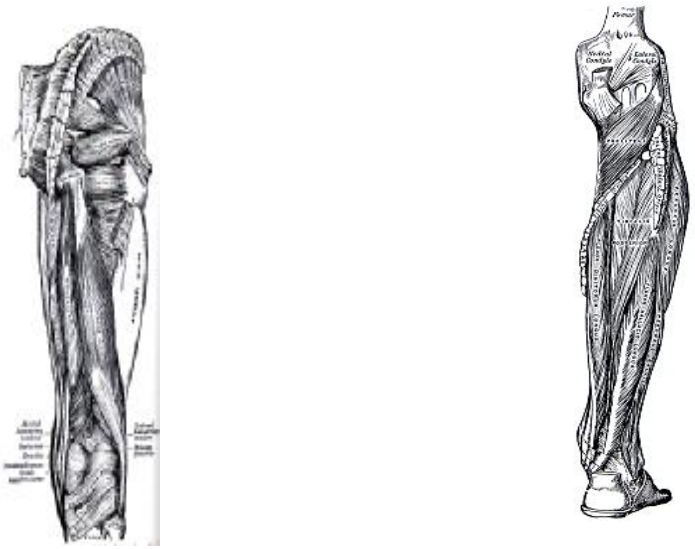
to adjust their motor program properly because they have 160 mc available. To goalkeeper (under these conditions); it is a precious time in defending his goal.

Kicking requires progressive accelerations of body segments. It contains a preparatory action commonly called a wind up or back swing. A wind up provides additional distance over which force is applied. It also pre stretches the athletes muscles ready for their explosive power. A fast and a strong kick require good range of motion in the kicking leg. This will lead to an increase the time and distance over which one can develop force. This action is beneficial to a goalkeeper because he has more time for prediction.

To execute an effective kick, a kicker uses both of his legs. First the player takes a step with his supporting leg and rests his foot near the ball then he winds up his kicking leg.

The supporting foot decides the path of the ball. This is true because at the time he swings his kicking leg backward, the body will stay on the supporting foot. Anatomically the direction of the body will follow the direction of the foot. Imagine that the kicker makes a lateral rotation in his supporting foot. That means he will stretches the interior and posterior muscle groups of the lower leg. Once he raises his kicking leg off the ground, the stretched muscles of supporting foot will return to their normal position and that will lead the body to follow the supporting leg (see figure 2). At the moment of kicking; the body faces the direction of the supporting foot and eventually the ball goes to the same direction of the longitudinal line of the supporting foot .On the top of that ;the range of motion of whole leg for both lateral and medial rotation is limited. If the kicker rests his supporting foot in lateral rotation that means he would rotate his whole leg from the hip joint laterally. This movement will lead to bring the other hip joint to the same direction. Eventually the other leg will move according to the supporting leg.

From this point of view a goalkeeper has an early clue about the ball direction at the moment the kicker rests his supporting foot. The kicker will swing his kicking leg backward as a preparation face for kick. During this time the goalkeeper makes his mind and decides the direction of his movement. The goalkeeper will move at the moment of kicking and that gives a proper time to react.



Posterior muscles of the thigh Muscles of Posterior aspect of the leg

(Fig -2) Show the normal position of the muscles groups of the leg

The normal speed of the kick is100km/hr or more. That means 27meter in one minute. In penalty kick; the ball is 10.91meter (12 yards) from the goal line which means the ball will reach the goal line in 500ms... This time is not enough for goalkeeper to perceive, think, make decision and act. Under these circumstances the goalkeeper has to find some indicators to depend on. Most goalkeepers watch the kicker movement while others make a pre decision to go to one direction. Both indicators have their own deficit.

1-RT is more because it requires selecting one of many stimuli. Goalkeeper has to identify the right stimuli. That means he has to identify ball direction (left or write) and altitude of the ball (low or high). Depending on these findings, goalkeeper, decides, then move accordingly.

2-Within 500msec (time of the ball to reach the goal), goalkeeper has to do both, mental operations and movement (reaction time+ movement time) to reach the predicted spot before the ball.

Thus ; if the goalkeeper concentrate on the supporting foot, he will beneficiary in the following manners.

1- Stimulus were abstracted because once the player rests his supporting foot, goalkeeper decides ball direction before kicking action. That will save him about the same reaction time (160msec).

2- During kicking, the goalkeeper has already pre decides the direction. That means he pick the proper (motor program) to move, but he has to adjust this motor program in term of the height of the coming ball. The fewer stimuli will lead to speed up reaction time and movement time which means speed up response time.

If the kicker tries to kick towards another direction he will face two problems:

1. Rotation to a different direction in hips in the same time is very limited.
2. Even if he tries to do so he will lose his control to point the ball properly.

To confirm this data the study analyzed FIFA world cup, Germany, 2006. Analyzing penalty kicks of the final match showed that all kickers directed there supporting foot to the same direction of the ball they plan to go.

Conclusions and Recommendations:

The results showed a new perspective concerning penalty kick direction. The ball's direction is the result of the direction of the supporting foot.

The study recommended using the indicator to decide the direction of the ball. It will add a new step for goal keeper training. It also recommended using experimental design for the goalkeepers to reach more concrete results.

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