

Effects of visual exercises training on developing ball velocity and accuracy shooting of penalty corner in field hockey

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Introduction

A great debate has taken place regarding the role of vision in sports performance and established that the vision is important for a good player performance in different sports in the last years.

In all sports, vision provides the athlete with information regarding where, when, and what to do. Regardless of the physical strength, speed, or technical skill of an individual, an ability to quickly and correctly process visual information can be the difference between elite and non-elite performers (Wimshurst et al., 2012).

Erickson (2007) suggested that, every sport requires a set of visual skills that are critical elements to sports performance and a good training of these specific skills that influence to strengthen specific visual abilities leading to actually improved performance in this sport.

There is no kind of sport can be mastered successfully without the players capability to use their visual skills, in this case (Campher, 2008) suggested, if a player had to constantly move his head to see what is going on around him, he would immediately lose sight of his running direction and not be aware of whatever important action is happening right in front of him.

(Schwab & Memmert, 2012) reported that, the capability of becoming aware of a movement or a situation a split second faster than an opponent is important in ball sports like field hockey as well as many other sports as it may offer athletes the decisive advantage.

The penalty corner is one of the strategic actions that determine the result in a match in field hockey. In addition, penalty corner is one of the most important game situations during field hockey match play, with one third of the goals resulting from this tactical situation (Laird & Sutherland, 2003; Mosquera et al., 2007). In this context, the striker has a very close distance to the goal and so the goalkeeper needs a great reaction time to save the shot during penalty corner play. Moreover, the player who hit the ball during penalty corner situation, need a good reaction time and some of visual abilities for completing the situation successfully.

There are lack studies investigated the visual abilities for field hockey players, (Bhanot & Sidhu, 1980) assessed the visual reaction time of 92 hockey players and found

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defenders had the fastest reaction times and midfielders the slowest, and (Calder, 1999) examined a wide range of visual skills (including peripheral vision, visual reaction time, visual acuity, visual memory, eye movement skills, visual concentration, visual recognition and balance) of elite hockey players and found no significant differences across playing positions.

Limited information is available on female field hockey player's visual skills and particularly on the trainability of accuracy and ball velocity in penalty corner. In addition and to my knowledge, there is the first study to investigate the effects of visual skills and its efforts when female players performed the penalty corner as an important situation during field hockey matches. The primary aim of this study was, therefore, to investigate the effect of visual training on visual abilities of field hockey female players. A secondary aim was to examine the effect of visual training on velocity of ball shooting in penalty corner of field hockey female players, and the third aim was to determine the effect of visual training on accuracy of ball shooting in penalty corner of field hockey female players.

Materials and Methods

Participants

A total of 12 skilled female field hockey players participated in current study. The personal and anthropometric characteristics mean \pm SD were age 19.73 ± 0.88 years; height 162.40 ± 5.08 cm; weight 62.08 ± 6.34 ; training experience 8.47 ± 0.64 years. These female players represent the team of Sharkia hockey club in Zagazig city and they are participated at the 1st division level of competition to the Egyptian national league, which took part from the Egyptian field hockey federation competitions.

Procedures

Female field hockey players performed the tests in two testing sessions separately, but in the first testing session participants performed the visual tasks tests (Double Labyrinth, Reaction Time, Time/movement anticipation and visual pursuit) and the grid concentration test; and in the second one, they performed the skill practical tests (shooting ball velocity and accuracy).

(1) Test session one

During this test session, all visual tests were investigated. The assessment of the different visual skill abilities was performed by the Vienna Test System (Appendix 1). This device is a computerized test for assessing different psychological and motor aspects (Schuhfried, 1992). The visual tests took part in the lab of faculty of physical education in Kafrelsheikh University. The female players performed 4 visual tests separately with rest period 5 minutes between every two tests, the procedures of visual tests will be described in the measurements part. In addition, the grid concentration test was performed during this test session after completing the visual tests.

(2) Test session two

Ball velocity when player hits the ball in penalty corner situation was investigated in the hockey field of Sharkia club. To determine the ball velocity during shooting, a high speed camera (Fastec imaging) with Shutter speed of 1/250 pro second was used. The software (Simi Motion) used to analyze the ball velocity during shooting trials in the penalty corner situation. The camera positioned vertically on the player at the right side, with height of 95 cm from the ground and 25 meter from the player. The experiment time was took part at 1-3 pm clock to avoid any errors during the video captures.

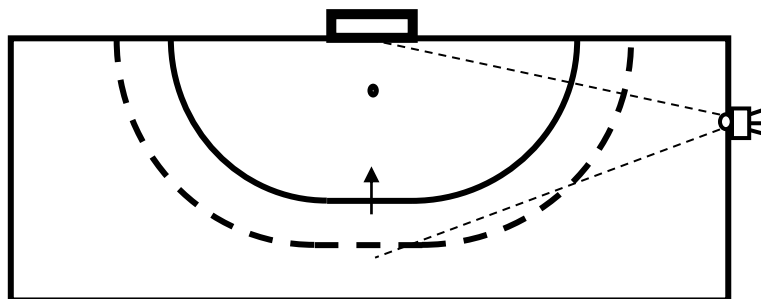


Figure 1. The description of ball velocity evaluation

Measurements

(1) Visual skill tests

Double labyrinth test

This test (Appendix 2) used for the eye-manual coordination assessment. Participant must maintain two circumferences along a lane without touching the lateral walls of the lane. Each of the circumferences left and right are controlling by one hand control device (corresponding with the side of the circumference). When one of the circumferences touches the wall is considering an error, and it turns into a red circumference. In addition, the test beeps a sharp sound until the circumference stops touching the wall. As the test progresses, lanes' difficulties increase. The test offers two results for each participant, total time on each hand error and total number of errors.

Reaction time test

With the Reaction Test (Appendix 3), the measurement of the reaction time is possible for single choice reactions and for simple multiple-choice reactions. The stimulus modalities light / tone and the characteristics red / yellow / white are available, so that different stimulus constellations for the measurement of reaction time can be produced. These can go from individual stimuli to simultaneous or sequentially presented stimulus combinations. The use of a rest and a reaction key makes the splitting into reaction and motor time possible. The player receives the instruction, to press the reaction key only when relevant stimuli are presented.

Time / movement anticipation test

In this test (Appendix 4) participants watched, on a white screen, the trajectory of a green projectile at a determined velocity and direction. In a moment the projectile

disappears between two red lines, participants must calculate the moment and the exact place where the projectile will appear again. As the test progresses, trajectories become more complicated.

Visual pursuit test

This test (Appendix 5) is used for assessing selective attention. The task consists of differentiating lines, which is indicated by a red arrow, from the other lines that cross. Each way has an identifying number at the end. Participants must follow the red arrow's line by pressing two buttons, at the same time. If a participant does not push one of the buttons, the screen with the possible ways disappears and he has to select the number of the line. Participants must focus on the red arrow's lane and ignore the others, for adding pressure the task must be completed in the minimum time possible.

(2) Grid concentration test

Grid Concentration Test (Appendix 6) is a dynamic approach to determine selective attention capacities and situational awareness. Mohamed (1998) had translated the version to Arabic language and the network test can help focus on a good selection of players who can focus their attention much better. The duration of the test is one minute and ask the player to put a sign (✓) on the largest possible number of digits that follow the number assigned determined by the coach sports or the psychologist athlete on the diagram on the following page should preferably be selected number is less than the number 65 taking into account that follow numbers a consecutive manner. For example, when you select the starting number 17 should be the player to develop a sign (✓) on No. 18 and then No. 19 and No. 20, and so on and not try to put a sign (✓) on the number 19 first and then the number 18 seconds.

(3) Shooting ball velocity and accuracy test

The shooting accuracy test (Appendix 7) is established to measure the accuracy of player when shooting the ball toward the goal during the penalty corner situation. The player allows hitting the ball with the front face of the stick. The players take his position and after the command signal of the tester, the player hitting 10 balls toward the goal from the penalty corner position (head of D circle). The tester recorded the total number of balls, which scored exactly at the target areas of the goal.

Visual exercises training

Visual exercises training (Appendix 8) was taken part of the basic training program and before the official training session of female players. The time period of the visual exercises training was between 42-144 minutes for every session, and the time of weeks were 8 weeks, which every week consists 3 training times.

The visual exercises training performed at the same rules of penalty corner situation during the field hockey matches. The outline of exercises allows every player to hit the ball about 10 to 15 times as players performed it during the penalty corner. The total

period of 8 weeks training included exercises, which represent about 76.9 % visual exercises, 15.4 % skills drills and 7.7 % tactical tasks training.

The intensity of visual training sessions was between 75 to 95% during the 3 sessions and the training drills was performed in the preparing period for the second round of season (23.01.2016 to 18.03.2016), and after the contributing at the African nation field hockey cup and during the last 12 weeks of the basic training program of the team, who trained every week 5 times for about 120 minutes.

Statistical analysis

Standard descriptive statistics (mean and standard deviation) were calculated for each variable. The independent t-test was computed to compare significant differences between pretest and posttests in selected measurements. Statistical significance was accepted at an alpha level of ($p\text{-value} \leq 0.05$). All statistical tests were performed by SPSS statistical software 16.0 (Chicago, IL).

Results

The means \pm standard deviations (SD) results of measurements in pretest and posttest are outlined in (Table. 1)

Measurements	Pre-Test	Post-Test	MD	<i>t</i> -statistic	<i>p</i> -value
<i>Visual tasks tests</i>					
Double labyrinth test (Degree)					
<i>Eye with left hand</i>	40.30 \pm 1.18	46.32 \pm 2.03	6.02	10.483	0.00*
<i>Eye with right hand</i>	41.10 \pm 1.72	45.97 \pm 1.08	4.87	9.576	0.00*
<i>Eye with two hands</i>	81.40 \pm 2.87	87.38 \pm 1.65	5.98	6.540	0.00*
Reaction time (Degree)	6.09 \pm 0.43	8.06 \pm 0.51	1.97	13.164	0.00*
Anticipation (Degree)	291.02 \pm 6.31	305.14 \pm 4.84	14.12	14.008	0.00*
Visual pursuit (Degree)	2.30 \pm 0.19	3.08 \pm 0.15	0.78	23.328	0.00*
<i>Grid concentration test</i>					
Concentration (Degree)	16.67 \pm 1.50	20.75 \pm 1.66	4.08	6.218	0.00*
<i>shooting accuracy test</i>					
Accuracy (Number)	1.75 \pm 0.97	5.00 \pm 1.35	3.25	10.162	0.00*
Ball velocity (meter/sec)	32.20 \pm 3.27	43.85 \pm 3.36	11.65	7.025	0.00*
<i>MD = mean difference, * Significant at 0.05 level (2-tailed) and t Critical two-tail = 2.201</i>					

The results of (Table. 1) demonstrate significant difference between pretest and posttest measurements of female field hockey players in visual tasks, concentration test and shooting test at ($p \leq 0.05$) in penalty corner situation and the statistics data confirmed that t-statistic values were greater than t-critical value by 22 degree freedom.

The percentage difference between pretest and posttest are outlined in (Table. 2)

Measurements	Pre-Test	Post-Test	Improvement (%)
<i>Visual tasks tests</i>			
Double labyrinth test (Degree)			
<i>Eye with left hand</i>	40.30 ± 1.18	46.32 ± 2.03	14.94
<i>Eye with right hand</i>	41.10 ± 1.72	45.97 ± 1.08	11.85
<i>Eye with two hands</i>	81.40 ± 2.87	87.38 ± 1.65	7.35
Reaction time (Degree)	6.09 ± 0.43	8.06 ± 0.51	32.35
Anticipation (Degree)	291.02 ± 6.31	305.14 ± 4.84	4.85
Visual pursuit (Degree)	2.30 ± 0.19	3.08 ± 0.15	37.83
<i>Grid concentration test</i>			
Concentration (Degree)	16.67 ± 1.50	20.75 ± 1.66	4.08
<i>Shooting accuracy test</i>			
Accuracy (Number)	1.75 ± 0.97	5.00 ± 1.35	185.71
Ball velocity (meter/sec)	32.20 ± 3.27	43.85 ± 3.36	36.18

The results in (Table. 2) demonstrate that the percentages of all measurements during the posttest were higher than pretest, and ranged between 4.08% in grid concentration test to 185.71% in shooting accuracy test.

Discussion

In general, the results of current study suggest that visual exercises training are important for good performance during the penalty corner situation in the field hockey matches. This study examined whether visual exercises is good method for developing the shooting ball velocity and accuracy of hitting.

The results found that visual exercises training significantly increased the visual skills such as the coordination of eye movement with one hand and two hands, and recorded an improvement of (14.94%, 11.85 and 7.35%) respectively. The findings of current results could be explained by the eye movement tasks in the training during 8 weeks, visual exercise tasks during penalty corner drills focused on eye tasks movements when female players shooting the ball right or left. In addition, these results of current study consists with previous studies by (Smith et al., 2001; Wimshurst et al., 2012), who reported that three visual tasks involve moving the eyes swiftly from one place to another and then focusing quickly employ for much of the hockey matches when they are watching the ball being moved around the pitch.

The results found that visual exercises training significantly increased the reaction time of players with an improvement of 32.35%. This finding of results could be explained by the designed drills at the skill exercise part training, which combined with the visual task of reaction time. In this context, the player takes some tasks which need a good reaction time during the performance of penalty corner situation. The results regarding reaction

time performance consisted with (Cañal-Bruland et al., 2010), who reported that more high speed tasks during training skills are important for the exact field treatments during field hockey match play.

The results found that visual exercises training significantly increased the time and movement anticipation of players with an improvement of 4.85%. This finding of results could be explained by the exercise drills, which allows player to anticipate the place of receiving the ball during the penalty corner situation at the D circle and before the hitting toward the goal. The results of current study regarding anticipation variable consisted with (Ciuffreda & Wang, 2004; Poltavski & Biberdorf, 2015), who confirmed in their meta-analysis study and underscored the importance of higher information processing skills like anticipation and decision-making in athletic performance and the ability of current sport vision programmes to specifically target these skills.

The results found that visual exercises training significantly increased the visual pursuit ability of players with an improvement of 37.83%. This finding of results could be explained by visual exercises training as a strategy for improving selective attention. In this sense, I suggest that training programs which include the developing of the selective attention can consider that a well design specific training for penalty corner situation in field hockey, where players must discriminate specific stimuli in order to score goals, are necessary to significantly improve this ability. The current study results of visual pursuit ability consists with study by (Land & Hayhoe, 2001), who confirmed that the ability to initiate a pursuit eye movement to maintain fixation of a moving object, as well as the ability to initiate an accurate saccadic eye movement for direct fixation from one object to another, are essential aspects in many daily activities.

The results found that visual exercises training significantly increased the concentration ability of players with an improvement of 4.08%. This finding of results could be explained by visual exercises training, which combined with specific shooting skill tasks. In this tasks the players must hits about 10 to 15 balls in exact targets on the goal, this task requires more concentration and good attention of players, thus this finding results explained the nature of shooting target tasks in the training sessions. The concentration results consists with previous study by (Jackson & Baker, 2001), who reported that the player concentration times tended to be shorter for kicks taken in the competitive environment when compared to the controlled experimental environment.

In context of technical results, visual exercises training significantly increased the shooting ball velocity and accuracy when player performed the penalty corner situation after posttest, and recorded an improvement of (36.18% and 185.71%) respectively. The findings of current study explained by the improvements of visual skill abilities, which included in the training session and during the penalty corner situation training. Visual skills such as eye coordination, reaction time, anticipation, visual pursuit and

concentration are vital for field hockey player when shooting the ball on the goal. The training drills of hitting balls during penalty corner focused on the attention and speed movement, which improved the accuracy and velocity of ball shooting. Female field hockey players showed more accurately on shooting after the visual tasks exercises, which require a good concentration when hitting balls from the circle and in special targets.

In general, the results of current study confirmed the study conclusions by (Dogan, 2009), who confirmed that sports such as field hockey require different visual abilities, and reported that goalkeepers have to face powerful shots coming toward them at different angles, heights, and speeds, defenders need to be able to watch the player they are marking as well as tracking the ball, which could be some distance away. Midfielders need to constantly be aware of what is happening around them to select the correct pass and make interceptions, while forwards need to use their skills to avoid a defender's tackle and spot spaces into which they can move.

Conclusions

Based on results of current study, it could be concluded that visual exercises training are vital for penalty corner shooter in field hockey sport. In addition, visual skills such as eye coordination, anticipation time and concentration were very important factors when players performed the penalty corner situation in field hockey matches. Technical variables such as velocity of ball and accuracy during shooting on the goal must be taken in the consideration of field hockey coaches. Finally, there is an important need to combine visual tasks with skill drills in the penalty corner specific training, which affect their playing performance in this situation.

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