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Original article

THE EFFECTS OF VISUAL TRAINING ON VISION FUNCTIONS AND SHOOTING PERFORMANCE LEVEL AMONG YOUNG HANDBALL PLAYERS

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Abstract

Aim. Vision is the most dominant sense, with 70% of all sensory receptors in the eye. Vision, with components such as visual skills, contributes up to 80% of information obtained. The purpose of this study was to assess the impacts of the visual training program on vision functions and shooting skill among young basketball players.

Methods. The sample consisted of 20 young handball players under 16 age (15.89 ± 1.36 years old; 175.16 ± 6.06 cm height; and 71.47 ± 5.51 kg weight), Training experience of all the participants ranged from 4 to 5 years. Subjects and coaches were required to read and complete a health questionnaire and informed consent document; there was no history of injuries, diabetes or recent surgery.All statistical analyses were calculated by the SPSS statistical package. The results are reported as means and standard deviations (SD). Differences between two groups were reported as mean difference ± 95% confidence intervals (meandiff ± 95% CI).Student's t-test for independent samples was used to determine the differences in vision parameters between the two groups. The $p<0.05$ was considered as statistically significant.

Results.

- There are significant differences at 0.05 between pre and post – tests of the experimental group in all visual functions variables, and shooting skill for the post – tests.
- There are significant differences at 0.05 between pre and post – tests of the control group in the eye and hand coordination, the eye and foot coordination and visual acuity, and no significant differences in the other visual functions and shooting skill.
- There are significant differences at 0.05 when the post – tests of control and experimental groups in all visual functions variables, and shooting skill for the post tests except the eye and foot coordination, visual acuity and visual depth perception from a distance of 10 cm.

Conclusions. Visual training program proved an effectiveness in improving the visual functions and shooting skill among young handball players.

Key words: Visual Training, Vision Functions, shooting skill, Handball

Introduction

Because handball is such a fast-moving sport, athletes are under enormous time pressure; as in racket sports, the time interval for preparing their own motor responses is so short that they have to anticipate their opponent's intentions (Azémar, 1999; Haase & Mayer, 1978). Handball coaches hypothesize that rapid responses to the opponent'sactions are one of the major factors that determine level of performance (Roi & Bianchedi, 2008). Becauseeven world-class players do not have faster than averagereaction times (see Di Russo, Taddei, Apnile, & Spinelli, 2006).

Harmenberg, Ceci, Barvestad, Hjerpe, & Nyström, 1991), their performance advantage is thought to be duenot just to physiological components (Roi & Bianchedi, 2008). Also—and above all—to the ability to make betterpredictions about the intended target of a handball attackby observing the opponent is preparatory phase (Azémar, 1999; Haase & Mayer, 1978).

Vision is the most dominant sense, with 70% of all sensory receptors in the eye. Vision, with components such as visual skills, contributes up to 80% of information obtained (Buys, 2002). In sports field, the Key sensory information needed by athletes during competitive sporting activities is provided by the visual system. It has been suggested that 95% of all physical movement is controlled visually and that this is the trigger mechanism for the first movement of the athlete. (Werner, 2000; Spinell, 1993).

Sports Vision (SV) is the branch of optometry concerned with vision and perception, evaluating and enhancing visual performance, and prescribing, where necessary, the most appropriate visual aids. (Pieer, 2010)

Sports vision can be defined as the study of

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the visual abilities that are required in recreational and competitive sports, as well as the development of visual strategies for improvement of accuracy, stamina, consistency and hence performance of the visual system (Daune, Darlene, 1997).

A coach may suspect visual problems when play is inconsistent, not up to potential or deteriorating over time, or the athlete is under mental or physical stress.

According to Pieer (2010) the Symptoms of handball Athletes with Possible Visual Problems are

- Poor ball handler
- Poor on the fast break, commits many turnovers
- Inconsistent or poor free-throw shooter
- Good shooter only when both feet are on the ground
- Can only shoot from certain side or distance on the court
- Unaware of other¹s positions on the court

According to Reichow and Stern (1995): Sports vision encompasses performance orientated comprehensive vision care programs involving education, evaluation, correction, protecting, and enhancement of an athlete." The involvement of vision, in any sport, is of paramount importance. The role of specialized sport vision practitioners may play an important role in either screening or correcting of athletes with visual defects and or help the athletes to perform7

In the past, vision training and visual skills were not appreciated in the everyday sport setting. Athletes and trainers did do vision related training inadvertently, but research has now shown the importance of visual skills in the performance of an athlete.

Generalized visual training programs have been popularized by many authors but scientific evidence indicating the usefulness of these programs in performance enhancement in sport are scarce. It is true that standardized visual parameters such as acuity, depth perception, accommodative and fusional ranges and flexibilities can be improved but the question is still whether this will result in improved sports performance. The bulk of the evidence clearly indicates that superior athletes do not perform better than the normal population on these visual abilities.

These conflicting reports may be the result of a one-dimensional view on the functioning of the visual system. Milner and Goodale (1995) suggest a "two visual system" hypothesis based on an anatomical distinction that divides the visual system into one system that deals with perceptual presentation of information and a second system that is responsible for visuomotor control. We would postulate that with visual training programs, the emphasis should be to deal with those visual skills that relate to visuomotor control in order to achieve improved sports performance

Over the past several years, the jump shooting distance in professional handball decreased and then subsequently increased after 3 years. The result may have been a change in reinforce probability and reinforcement rate for shots for some players. For these players, as the line was moved closer, shooting may have been more likely to be reinforced, thus producing a higher rate of reinforcement. When the line was moved back to its original distance, the likelihood of making a shot then decreased.

Data from the 1992 Olympics revealed some interesting statistics:

- Only half of the competitors had ever had their eyes examined.
- Yet one in four admitted to visual difficulties.

Data from the Winter Games of 1994 revealed that:

- 58% of competitors rating vision important had never had an eye examination;
- 19.59% wore spectacles but only 3.2% used them for sport, compared with 94.3% of contact lens wearers;
- 12.5% had substandard acuity in one eye and 4.6% had substandard acuity in both eyes. (Olympic Vision Centre, 1995)

Any athlete with a visual difficulty may visit an optometrist, but sports vision is about much more than the standard sight test. With sports vision, the entire visual system comes into consideration.

Hence, the present study is an attempt to assess the impacts of the visual training program on vision functions and shooting skill among young handball players.

Methods

Experimental approach to the problem

Two groups (experimental and control) performed a pre and post - training designed intervention in which Eye-hand coordination (EHC) , Eye-foot coordination (EFC) ,visual acuity (VA) , Visual memory (VM), Visual Tracking (VT) , visual reaction time (VRT) , Depth perception (DP) from different distances (10cm , 20cm and 30cm) , Visual field (VF) and Performance level of shooting skill (3PS) were recorded. The experimental group (EG) (10 young handball players) trained 1 hour per day 3 times a week on visual training besides the handball drills for Ten weeks. The control group (10 handball players) continued their normal training (handball drills). While the experimental group completed a visual training program to see whether this type of training modality would have a positive or negative or no effect on (EHC), (EFC), (VA), (VM), (VT), (VRT), (DP), (VF) and (JSS).

Samples

20 young handball players under 16 age (15.89 ± 1.36 years old; 175.16 ± 6.06 cm height; and 71.47 ± 5.51 kg weight), Training experience of all the participants ranged from 4 to 5 years. Subjects and coaches were required to read and complete a health questionnaire and informed consent document; there was no history of injuries, diabetes or recent surgery. The anthropometric characters is described in Table 1.

Training protocol

The 10-weeks in-season training program consisted of SIX types and levels of exercises:

- Level 1: Head Positioning Exercises
- Level 2: Dynamic Visual Acuity Exercises
- Level 3: Eye Tracking Exercises
- Level 4: Eye Teaming & Depth Perception Exercises
- Level 5: Peripheral Vision Exercises
- Level 6: Eye-Hand Coordination Exercises

Testing procedures

Subjects were assessed before and after 10-weeks of visual training program all measurements were taken one week before and after training at the same time of day. Tests followed a general warm-up that consisted of running, calisthenics, and stretching.

Eye-hand coordination (EHC): Receive and throw balls test. The object stand against a wall and behind the line drawn on the ground where the test is in accordance with the following sequence.Threw the ball five times in a row on the right hand to the object receives the ball bounced off the wall after the same hand. Threw the ball five consecutive times with the left hand on the object receives the ball bounced off the wall after the same hand. In addition, threw the ball five times in a row on the right hand that the object receives the ball bounced off the wall after the left hand and calculated for each degree, any class that is the final (15) degrees.

Eye-foot coordination (EFC): Jump inside the circles numbered. The object stand inside the circle number (1), when you hear the signal the object jump by feet together to the No. (2) And then to the circuit number (3) and then to the circuit No. (4) And so on until the circuit No. (8) Records of the object time it takes to move through the eight circles

Visual acuity (VA): shooting on the overlapping circles. The object stand behind the line and then corrected the five successive balls trying to hit smaller constituencies. If the ball hit the small, circles (or lines inside the circle assigned to them) is calculated for the object (3) degrees. If the ball hit the circuit is calculated for the Central object (2) degrees. If you hit the ball great circle is calculated by one degree. If you hit the ball outside the three circles is calculated zero degrees.

Visual reaction time (VRT): the player stands in front of the reaction time device and holding the handball with both hands and waiting to see the light (exciting). Player is required to thrown the ball on the pillow for a moment see the white light on the plate in front of him as soon as possible. (The moment of response) which gives a time to the nearest 1 / 100 of a second and reflect the period from the moment of light pressure until the moment the player on the compressor on the reaction time. Given to the player (5) attempts to test irregular intervals.

Visual memory (VM): Visual Memory Game,http://ababasoft.com/flash_games/memory_visual.html

Visual Tracking (VT): the player stands in beside - front of the coach, the coach threw the ball in front,and the object tell the color of the stickers on the ball.

Visual field (VF): the player sitting and looking eyes and unconscious the other eye. is moving the signal from the halfway point-to-end circuit using the index and in the direction indicated to the player. Continue to be from scratch in a move the cursor up to lose sight of the lab without moving his head the laboratory. This process is repeated in eight axes (axes indicated on the drawing) at an angle of 45 degrees each time until the laboratory is a full course 360 degrees.

Depth perception (DP): Kreczanski device is a wooden box without a cover and without the front table is placed the highest measurements 100 cm length, 40 cm display, 15 cm high. Contains sticks connected to estimate the distances of each square 2 cm × 2 cm, 10 cm high. A black curtain placed on the front side of the Fund to change attempts. Variable height chair is placed a distance of 6 meters from the device. (Quintana, et al. 2007).

Statistical analysis

All statistical analyses were calculated by the SPSS statistical package. The results are reported as means and standard deviations (SD). Differences between two groups were reported as mean difference ±95% confidence intervals (meandiff ± 95% CI).Student's t-test for independent samples was used to determine the differences in vision parameters between the two groups. The $p<0.05$ was considered as statistically significant.

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Results

Table 1. Theage, Anthropometric Characteristics and Training experience of the Groups (Mean ± SD)

Group	N	Age [years]	Weight [kg]	Height [cm]	Training experience
Experimental	10	15.89 ± 1.34	71.47 ± 5.9	175.16 ± 6.06	4.00 ± 1.5
Control	10	15.00 ± 1.01	70.35 ± 5.1	173.29 ± 6.2	3.94 ± 1.3

Table 1 shows the age and anthropometric characteristics of the subjects. There were no significant differences were observed in the anthropometric characteristics and Training experience for the subjects in the two groups.

Table 2. Mean ± SD and (T) Test between pre – tests and post - tests in vision functions and Performance level of shot for experimental group .

Variables		Experimental group		T value	Sig.
		Before	After		
Eye-hand coordination (EHC)		9.12±1.33	13.05±1.79	6.55	Sig.
Eye-foot coordination (EFC)		9.77±0.35	8.84±0.51	7.03	Sig.
visual acuity (VA)		11.41±1.69	12.97±1.73	7.15	Sig.
Visual memory (VM)		2.86±0.25	2.22±0.31	6.87	Sig.
Visual Tracking (VT)		5.31±1.47	8.70±1.53	7.54	Sig.
visual reaction time (VRT)		0.85±0.05	0.78±0.07	9.8	Sig.
Depth perception (DP)	From 10cm distance	5.88±0.51	4.81±0.27	7.55	Sig.
	From 20cm distance	7.66±0.43	6.29±0.49	7.33	Sig.
	From 30cm distance	9.42±0.55	7.38±0.42	6.8	Sig.
Visual field (VF)	Perpendicular to the top	65.38±2.49	72.64±2.53	5.2	Sig.
	Vertical Down	65.19±3.14	73.04±2.11	5.24	Sig.
	Horizontal right	71.73±3.62	84.45±3.49	8.04	Sig.
	Horizontal lift	72.81±2.24	85.2±2.76	8.95	Sig.
Performance level of shot		13.48±5.37	17.69±6.34	2.67	Sig.

Table 2 shows that: Significant Difference between pre – tests and post - tests in all vision functions and Performance level of shot for post - tests.

Table 3. Mean ± SD and (T) Test between pre – tests and post - tests in vision functions and Performance level of shot for control group.

Variables		Control group		T value	Sig.
		Before	After		
Eye-hand coordination (EHC)		9.49±1.69	10.55±1.83	3.42	Sig.
Eye-foot coordination (EFC)		9.69±0.62	9.16±0.54	3.11	Sig.
visual acuity (VA)		11.39±1.87	12.59±1.89	2.39	Sig.
Visual memory (VM)		2.80±0.38	2.73±0.46	1.46	No Sig.
Visual Tracking (VT)		5.11±1.55	5.93±1.67	1.59	No Sig.
visual reaction time (VRT)		0.84±0.09	0.83±0.08	0.97	No Sig.
Depth perception (DP)	From 10cm distance	5.91±0.49	5.09±0.71	2.01	No Sig.
	From 20cm distance	7.59±0.87	6.97±0.83	2.02	No Sig.
	From 30cm distance	9.38±0.68	8.46±0.79	1.99	No Sig.
Visual field (VF)	Perpendicular to the top	66.09±2.57	68.37±2.83	0.78	No Sig.
	Vertical Down	65.34±3.29	69.25±2.76	0.69	No Sig.
	Horizontal right	72.14±3.55	76.33±3.68	1.59	No Sig.
	Horizontal lift	71.97±2.39	75.34±2.91	1.37	No Sig.
Performance level of shot		12.59±4.86	14.08±5.11	1.22	No Sig.

Table 3 shows that: Significant Difference between pre – tests and post - tests in (EHC), (EFC) and (VA) and no Significant Difference between pre – tests and post - tests in others vision functions and Performance level of shot.

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Table 4. Mean ± SD and (T) Test between post - tests in vision functions and Performance level of shot for experimental and control groups.

Variables		Experimental group	Control group	T value	Sig.
Eye-hand coordination (EHC)		13.05±1.79	10.55±1.83	4.22	Sig.
Eye-foot coordination (EFC)		8.84±0.51	9.16±0.54	1.88	No Sig.
visual acuity (VA)		12.97±1.73	12.59±1.89	0.46	No Sig.
Visual memory (VM)		2.22±0.31	2.73±0.46	3.92	Sig.
Visual Tracking (VT)		8.70±1.53	5.93±1.67	5.33	Sig.
visual reaction time (VRT)		0.78±0.07	0.83±0.08	2.5	Sig.
Depth perception (DP)	From 10cm distance	4.81±0.27	5.09±0.71	1.65	No Sig.
	From 20cm distance	6.29±0.49	6.97±0.83	3.09	Sig.
	From 30cm distance	7.38±0.42	8.46±0.79	5.14	Sig.
Visual field (VF)	Perpendicular to the top	72.64±2.53	68.37±2.83	5.62	Sig.
	Vertical Down	73.04±2.11	69.25±2.76	4.74	Sig.
	Horizontal right	84.45±3.49	76.33±3.68	7.00	Sig.
	Horizontal lift	85.2±2.76	75.34±2.91	9.93	Sig.
Performance level of shot		17.69±6.34	14.08±5.11	2.46	Sig.

Is clear from Table (4) significant differences at 0.05 between post - tests of control and experimental groups in all the variables, except for (EFC), (VA) and perception the depth of vision from a distance of 10 cm.

Discussion

The main findings from this study were the significant Improvements in the vision functions and in Performance level of shot, which proved the visual training efficacy.

Athletes successful in shooting generally have better visual skill abilities that set them apart from nonathletes (Kluka & Knudson, 1997). It is essential for an athlete not only how good his eyesight is, as it might be measured by looking at a standard eye chart, but also how good his vision is, that is, how well his brain can interpret the information his eyes pick up, particularly when that information involves moving objects that may be glimpsed only for a split second.Hence vision training helps the athlete in having faster judgment and response in the game as visual information enhances the ball catching skill (Laurent et al., 1993).

The relationship between vision and motor in sport performance has been discussed in introduction of this study. The one system is dependent on the other system to perform successfully. Thus, with sport performance, if the visual system is not working efficiently, the athlete cannot perform to his/her potential. That is one of the reasons why vision is such an important factor when one evaluates an athlete's performance.

Attention should be given to the specific visual skills that the athlete needs to perform42. This will make sure that the visual system is efficient for sport performance, and contribute to successful performance.

From the results, it could be deducted that on some of the skills that were tested, the experimental group performed significantly better than the control group. There were also tests where the experimental group performed better but these results were not significant.

The difference in these skills between the older and the younger group may be attributed to a number of factors.

the experimental group performing better could be that the experimental group were subjected to training of general and specific skills for longer. Bressan (2003) investigated the training of visual skills. According to her, you get three methods of training. The first method is the visual skills training programme. Hardware visual skills will fall under this method. It is explained that this is typically associated with optometric procedures, in other words eye exercises. But, as mentioned earlier, these are not the limiting factors in skilful performance. The limiting factors are those associated with feedback for motor control, postural control, perception and balance, thus, cognitive aspects (software). The second method discussed, is vision coaching. This refers to normal coaching sessions with integrated visual cues and special vision drills. In other words, it is the improvement in the software of the visual system. The third method is called the sports vision dynamics. This method includes contents from sport optometry, coaching, biomechanics, motor control and the psychology of perception. In other words, hardware and software combined. The study showed better results when the athletes were trained with the third method, although the other two methods also showed improvements. In Bressan's (2003) study a control group underwent no specific visual training, only normal sport training. The athletes in this group did not perform significantly better after they underwent normal sport training.

The age group handball players in this study also underwent no specific visual training beforehand. Therefore, if the control group in Bressan's33 study performed poorly because of no visual training, one could similarly expect the same for the age group handball players. Specific visual skill training does work, and should be considered on the athletes in this study. However, when working with young athletes one should just be careful not to be too specific about the skills trained. A wide range of skills should be trained as not to limit the athlete's potential by becoming to sport specific to soon.

Conclusion

The results of the present study indicate significant improvement in the Performance level of shot among younghandball players after ten weeks of vision training. The basic visual skills such as reaction time, movement time, depth perception, and eye hand / foot coordination were enhancedbecause of vision training which led to the improvement in the motor skills.

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