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The Effect of Sports Vision Training on Visual-Motor Perception and Performance in Kata in the Teenager

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Abstract

Objective: This study was aimed at the determination of the effect of sports vision training on visual-motor perception and performance in karate kata.
Methods: The participants were 24 athletic in karate kata (10-12 yr) with an orange belt in Kata. Participants were chosen and randomly assigned into two groups of sports vision training (n=12) and control (n=12). The pretest includes visual-motor perception test and measurement of karate kata performance. After the pretest, vision training group engaged in kata practice and sports vision training for 8 weeks. During this period, the control group only engaged in kata practice. After completion of the training course, a posttest similar to the pretest was administered. For Data analysis, analysis of covariance was used.
Results: The findings showed the superiority of the vision training group in visual-motor perception and performance in Kata.
Conclusion: The finding showed that sports vision exercise can increase the performance of closed skills.

Introduction

The eyes are the most complex organ in the body after the brain. The eyes produce 36,000 bytes (units of information) per hour, and thus about 85% of all our information is obtained through the eyes (Wilson & Falkel, 2004). Each eye has six external muscles. These muscles can act individually or in combination with each other, allowing the eye to rotate and move. There are five possible movements for the eye, two of which are reflex in nature and the other three movements are voluntarily controlled. The purpose of the two reflex eye movements is to maintain the image or images of vision on the area of the yellow retina. Three types of voluntary eye movements can also be created for three purposes: (1) chase objects that move slowly in space (2) the speed of eyes moving from one point to another (3) Fixing look on objects at different depths of our field of vision.

One of the questions that researchers are trying to answer is whether exercising the visual system can help improve sports performance. Most athletes increase the strength and endurance of their muscles to improve their performance in sports;

although the eyes play a role in providing more than 80% of sensory information, they ignore the muscles of this system. Perhaps one of the reasons for this inattention is the misconception that visual function is the same among athletes (Wilson & Falkel, 2004). However, in a few studies, the effect of sports vision training on visual function and sports performance has been investigated (Rose & Christina, 1997).

Sports vision training refers to a set of techniques that are used to develop the visual function and to improve motor function (Wilson & Falkel, 2004). There is some evidence that eye muscle training can affect visual skills (Alfailakawi, 2016; Badami, Mahmoudi, & Baluch, 2016; Jenerou, Morgan, & Buckingham, 2015; Khanal, 2015; Krzepota et al., 2015; Schwab & Memmert, 2012; Tate, Paul, & Jaspal, 2008). For example, Tate et al. examined the effect of sports vision training on throwing skills in cricketers. The results showed that six weeks of visual training had a positive effect on visual reaction time, depth perception, saccade movements, and sports performance of athletes (Tate et al., 2008). Du Toit et al. examined the effect of 8 weeks of sports vision training on rugby players' visual skills. This study showed that sports vision exercises improve reaction time, eye-hand coordination, accuracy, and visual memory (Du Toit et al., 2012). Schwab et al. investigated the effect of sports vision training on selective reaction time and peripheral vision of hockey athletes. Findings showed that sports vision training improves athletes' selective reaction time and environmental vision (Schwab & Memmert, 2012). Although these studies have shown that sports vision training improves visual skills and athletic performance, some other studies have reported that following sports vision training inconsistently, visual skills do not improve (Wood & Abernethy, 1997). Aberneti and Wood made major criticisms on studies that measured the effect of sports vision training on vision development. According to them, the eye exercises performed were very similar to the tests used to measure visual function, and therefore the observed improvement may be related to test similarity. They also acknowledged that sports vision training on sports performance may be due to the effect of disruptive variables such as increased self-confidence (Abernethy & Wood, 2001). In two studies by Abernethy et al. (Abernethy & Neal, 1999; Abernethy & Wood, 2001), which a placebo group was added, no significant improvement in athletic performance was observed after four weeks of visual training. Some studies have emphasized the specificity of vision needs for different sports (Mallahi A, Ghasemi AS, & A, 2014) and have pointed out that the effect of sports vision training on vision and sports performance depends on the specific visual needs for that field and designed exercises.

Considering that most studies have examined the effect of sports vision training on visual and athletic performance in ball sports and in unpredictable environments, the question is that, given the specific vision needs of each sport, does sports vision training also affect karate vision and sports performance? Karate is made up of two almost different fields: Kata and Kumite. In the Kumite, two fighters stand against each other and give the appropriate response during the fight as soon as they see the opponent (Nakayama, 1979). On the other hand, in the field of Kata, there is no real opponent, and kata players do not receive a stimulus from the opponent while performing Kata (unlike outdoor sports), perform only a series of standard predetermined movements with all their strength, speed, power and agility. Kata requires a high degree of sequence, focus, and visualization, which are different from the needs of ball skills and skills that are practiced outdoors. In several previous studies, the effect of sports vision training on reaction time and other visual skills related to the external stimuli has been measured. (E.g., 9 and 19) but since Kata is performed in a closed environment, the reaction time is less critical. In Kata, motor vision perception seems to play a more important role than reaction time or visual skills related to the entry of external stimuli. Therefore, the aim of this study was to determine the effect of a course of sports vision training on visual-motor perception and sports performance in Kata in the teenager.

Method

The present study was a quasi-experimental with pretest-posttest design with a control group. The participants of the present study consisted of 24 male Kata players aged 10-12 years with an orange belt that were randomly selected and randomly arranged into two groups: control and experimental. All participants signed a consent form to participate in the study.

Data collection tools

To collect information, the Bender-Gestalt test and Kata test were used, which are mentioned below.

Kata test

In the present study, Heian Shodan kata (Shotokan style Kita No. 5) was used as an experimental task. In beginner training, Heian Kata is taught as the last Kata. A ten-value scale was used to quantify kata data. This scale is commonly used in kata competitions (Nakayama, 1979). In this scale, according to Table 1, scores were assigned to essential factors in Kata's implementation. If the participant forgets a part of the Kata during the performance, 1 point will be deducted from his performance, taking into account 5 seconds, and 2 points will be deducted from his performance if he provides help. The scores were presented by three qualified judges with a first-class kata refereeing certificate from the Karate Federation, and finally, the average scores were considered as the participant's score.

Table 1: Kata performance measurement scale.

	Technique	kiai	Breathing	Zanshin (focus)	Rhythm	Speed	strength	Forgetting	Forgetting with help	sum
Percentage	30/0	0/05	0/05	0/20	0/20	0/10	0/10	-	-	0/100
Total score	3	0/5	0/5	2	2	1	1	-0/1	-0/2	10

Bender-Gestalt Motor Vision Test II

The assessment of visual-motor skills is mainly done by assessing the child's ability to draw and coordinate his eyes and hands. One of the tools used to assess these skills is the Bender-Gestalt Visual-Motor Skills Test. This test measures visual-motor skills by copying geometric images. Bender-Gestalt Motor Vision Test consists of 9 pictures designed to assess visual-motor skills. The basis of test scoring is based on zero and one system. In this test, the participant's mistakes are scored. The validity of this test has been confirmed, and its reliability has been reported to be 0.80 (7).

Sports vision training protocol

From the book exercise vision exercises (22), optical stimulation exercise, spiral rotation, string attached to the ball, exercise with the swinging ball, chase the ball with the finger, exercise the rotating colors, exercise the ball in the carton, exercise the reversible cards and rope pull training was selected and used in the training protocol.

Data collection method

Participants were randomly selected and randomly arranged into two control (n = 12) and experimental (n = 12) groups. The experimental group performed sports vision exercises along with karate kata exercises for 8 weeks. The control group practiced karate kata for 8 weeks. Before and after eight weeks of training, visual perception was measured by the Bender-Gestalt 2 test and kata performance was measured by Heian Godan kata.

Statistical analysis method

One-way covariance analysis was used to compare posttest scores of visual perception and performance of the two groups, along with controlling the effect of pretest scores. Before using the covariance analysis, the hypothesis of data normality was checked by the Shapirovik test, and the assumption of homogeneity of variance was checked by the Levin test. The hypothesis of homogeneity of the regression slope was also examined.

Results

The descriptive findings of the research variables are presented in Table 2.

Table 2. Statistical indicators of research variables.

	Experimental Group		Control Group		Significance Level	
	Post-test	**Pre-test**	**Post-test**	**Pre-test**	**Group**	**Pre-test**
Visual perception	1.16 ± .14	3 ± .87	1.5 ± .42	1.5 ± .57	.001	<.001
Kata performance	6.87± .95	6.74± .41	6.47± .67	6.19± .53	.001	<.001

After making sure that all the necessary assumptions were made to perform the analysis of covariance, one-way covariance analysis was used, the results of which are summarized in Table 3.

Table 3. Results of analysis of variance.

Variable	Group	Marginal Average	Homogeneity of Variance	Sum of Squares	DF	Average of Squares	F	Sig
Visual-motor perception	Experiment Control	0.66 2.01	0.108	9.39	1	9.39	21.17	0.000
Karate kata	Experiment Control	8.66 6.69	107	18.28	1	18.28	173.23	0.000

The values in Table 2 indicate that there is a significant difference between the experimental and control groups in terms of karate kata mean and motor vision perception after controlling the pretest score (Sig <0.05). In other words, the average variable of karate kata and motor vision perception among the experimental group in the posttest stage is significantly better than the control group, so a course of sports vision training has affected kata players' performance and motor vision perception.

Discussion and Conclusion

There is some evidence that the visual system, like other organs of the body, can be improved by specific visual exercises (Cross, Stadler, Parkinson, Schütz-Bosbach, & Prinz, 2013). Accordingly, the aim of this study was to determine the effect of a course of sports vision exercises on motor vision perception and kata performance in Kata in the teenager.

The findings of this study showed that a course of sports vision exercises improves motor vision perception and kata performance in beginners. This finding is consistent with the findings of the studies of Krueger, Kamper, and Smith (Kruger, Campher, & Smit, 2009), Tate et al. (Tate et al., 2008), and Zupan et al. (Zupan, Arata, Wile, & Parker, 2006). Krueger, Kamper, & Smith measured the effect of 8 weeks of simultaneous exercise with sports vision exercises on 11 visual skills, including adaptive ease, depth perception, tracking, saccades, vigilance, hand-eye-foot coordination, visual memory, prediction, accuracy, color vision of skilled cricketers. The findings of this study showed that sports vision training had a positive and significant effect on all visual skills except depth perception and saccade movements (Kruger et al., 2009). Tate et al. Examined the effect of practicing visual skills on the visual skills of male cricketers. The results showed that six weeks of visual training had a positive effect on visual skills and athletic performance of athletes (Tate et al., 2008). Zupan et al. Measured the effect of sports vision training on irregular rapid eye movements, adaptation, version (convergence and divergence), eyes-hands' speed, and coordination, and concluded that with increasing number of training sessions, visual function increases (Zupan et al., 2006).

The positive effect of sports vision exercises on vision perception can be explained by two hypotheses. The main hypothesis of sports vision training is that the pressure applied to the systems related to visual-motor perception and deep visual receptors prepares the person to face pressure conditions during competition (Wilson & Falkel, 2004). Another hypothesis of sports vision training is that the visual system, like the musculoskeletal system, responds well to the principle of overload and becomes more trained with training (Tate et al., 2008).

The positive effect of sports vision training on motor skills can be argued that by increasing the sense of the depth of vision after vision training, the motor function of the sports vision training group may improve due to better seeing the position of the limbs and consequently, better perception of body position.

Sight provides us with a lot of information about the position of the body, limbs, and the direction of movement of the body in space (McMorris, 2014). So perhaps following vision training, sports orientation has also improved. Also, balance plays an essential role in the field of Kata (Filingeri, Bianco, Zangla, Paoli, & Palma, 2012). Balance has probably increased following sports vision training (Meshkati, Namazizadeh, Salavati, & Meshkati, 2010). A simple experiment to prove the role of vision in balance is maintaining balance on one foot with the eyes open and closed. Peripheral vision depends on our position relative to the floor, ceiling, and walls. They give us good information about our body's position. All this information helps us to understand the state of balance.

However, the findings of the present study are inconsistent with the findings of Wood and Aberneth (Wood & Abernethy, 1997) and Aubrenty and Neal (Abernethy & Neal, 1999). Wood and Aberneti (Wood & Abernethy, 1997) investigated the effect of a course of sports vision training on visual and motor performance. In this study, 30 participants who did not have experience in rocket sports were divided into three groups of visual training, placebo, and control based on visual and motor test. All three groups had a 20-minute exercise session to ensure that participants had ample opportunity to coordinate any changes in visual system function with their motor system. The vision training group practiced sports vision exercises for four weeks and four sessions per week. The Placebo team studied the book or watched recorded tennis matches for four weeks and four sessions per week. The control group practiced only 20 minutes of exercise. Based on the results, significant improvements were observed in some aspects of vision in the visual training group, but the researchers acknowledged that there was no evidence that visual training improved visual and motor function beyond the familiarity levels of the test. Abernetti and Neal (Abernethy & Neal, 1999) performed standard vision tests on 11 skilled shooters and one beginner shooter to determine the difference in visual performance between skilled and novice shooters. Skilled people were better only in reaction time, and beginners in a few other vision skills. More interestingly, skilled individuals' visual function was in the normal range and not higher than that of normal individuals. Accordingly, it was argued that sports vision training could not improve sports performance.

A review of research on the effect of sports vision training on vision and sports performance mentioned in the previous paragraph reveals contradictory research findings in this area. Perhaps the most important reasons for this discrepancy are the lack of standard vision tests to measure vision specific to each sport (Abernethy & Wood, 2001), differences in training duration and type of exercise (Mallahi A et al., 2014), differences in skill levels and age of participants, failure to identify important visual skills in each sport and subsequent use of inappropriate sports vision training protocol (Mallahi A et al., 2014). The use of vision in sports experts is different from that of beginners (Abernethy & Neal, 1999; Magill & Anderson, 2010). Differences in the use of vision may require different visual skills. The age difference of the participants may also be a factor in the discrepancies in the findings. Some of the visual abilities of children have not been developed to a certain age, and some visual skills have decreased in the elderly. Therefore, the visual needs of children, young people, and the elderly may not be the same. Wilson and Falkel reviewed the visual needs of seventeen sports and acknowledged that the sports requirements were different. For example, it is mentioned that convergence and divergence are not important in diving, but one of the important visual needs is in baseball, basketball, American football and gymnastics, or the sequence in boxing is not important, but is one of the important visual needs of diving, figure skating and gymnastics (Wilson & Falkel, 2004).

In summary, this study's findings showed that sports vision training improves motor vision perception and sports performance. Accordingly, the visual system seems similar to other bodily movement systems and can be trained by exercise.

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