



THE IMPACT OF VISUAL SKILLS TRAINING PROGRAM ON BATTING PERFORMANCE IN CRICKETERS

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Abstract Success in sports depends on athlete's ability to develop and perfect a specific set of perceptual, cognitive and motor skills. The aim of the study was to investigate the influence of specific visual training program on batting performance in cricket players. Thirty club level male cricket batsmen were randomly divided into three equal groups. The experimental group followed six weeks of visual training program, on alternate days. The placebo group was given simple reading material and watched televised cricket matches for six weeks' duration, while the control group followed routine cricket practice. Pre- and post- test results were obtained for reaction time, depth perception, accommodation, saccadic eye movements and batting performance. Statistical analysis indicated significant improvement in all mentioned visual variables and batting performance in the experimental group ($p < 0.001$). The placebo ($p < 0.05$) and control group ($p < 0.05$) also showed some improvement in batting performance but no significant improvement in visual variables was observed ($p > 0.05$). It can be concluded that the visual training program improves visual skills of cricketers, which could lead to improvement in the batting performance.

Key words: batting performance, visual training, visual skills, cricket

INTRODUCTION

Sports coaches, performers and scientists are constantly in search of new means to enhance sports performance and gain a competitive edge. Sports vision is conceived as a group of techniques directed to preserve and improve the visual function with a goal of enhancing sports performance through a process, which involves teaching the visual behavior required for different sporting activities [22]. In high speed ball games like cricket, vision is the undisputed king among special senses. Such games are characterized by perceptual uncertainty and time constraints that require a performer to process visual information and react in fractions of seconds [24].

The velocity of balls bowled by a fast bowler ranges from 140-150 kmph. The target object, in this case the ball when it reaches velocity that great, exposes the constraints of the human visual system. In most such sports the coach's advice is to "keep your eyes on the ball and hit through the line of the ball" however, when the ball moves fast, this strategy may not always be possible or appropriate. The factors contributing to exceptional batting and the qualities that define the batting expertise needs to be investigated. These include personal, sociological, demographic and developmental factors, deliberate practice, a superior visual function, a strong psyche, superior cognitive skills, superior visual perceptual skills, technical proficiency and superior morphological and physiological attributes. Among these, visual perceptual factors are one of the most important for cricket batting. Some of the important visual skills required for cricket batting are: static and dynamic visual acuity, depth perception, eye movements, peripheral vision, accommodation and eye-hand coordination. It is established that highly skilled players have better visual abilities than non athletes [8]. The consensus is that expert and novice athletes are not characterized by differences in basic visual skills [1, 27], but several of the recent studies show that visual

training can improve sports performance [14]. Although these studies highlight the potential of perceptual training programs, various shortcomings in the literature prevent a clear evaluation of their usefulness.

Most researchers have failed to use placebo or control groups in addition to the training group. The improvement in the performance observed may, therefore, be due to conformation bias or increased familiarity with the test environment rather than any meaningful training effect [9, 26]. Also, researchers have neglected to use suitable transfer tests to examine whether training facilitated performance in the real world context [12, 21].

The present study tried to control all these inadequacies and external variables related to cricket performance such as physical, technical as well as psychological. Thus, we could observe solely the effects of vision training on batting performance. The purpose of the present study was to observe the impact of visual training on visual skills and thereby on batting performance in cricket, so the study tested the hypothesis that the visual training program could improve the visual skills, which may lead to an improvement in batting performance of the cricketers.

MATERIAL AND METHODS

SUBJECTS / SAMPLES

30 club level male cricket batsmen, aged 16-25 years, having an experience of at least one year of playing competitive cricket were included in the study. Only subjects with 6/6 vision were selected and those with refractive errors or disease were omitted from the study. The written informed consent was obtained from all the subjects. The study was approved by Institutional Medical Ethics Committee of Guru Nanak Dev University, Amritsar.

EXPERIMENTAL PROCEDURE

The study was experimental with different subject design. The subjects were randomly assigned to three equal groups- the experimental group, the placebo group and the control group. The dominant eye and hand were determined by questionnaire and confirmed using Bryden [6].

VISUAL VARIABLES

Pre- and post- training data on following parameters were collected from all three groups.

Simple reaction time and movement time was measured using the Reaction timer (Mouart, Lafayette instrument, USA).

Depth perception ability was measured by the electronic depth perception device (DP-129, Medicaid Systems, India). In this test subjects were asked to align the central movable rod with two fixed rods.

Saccadic eye movement protocol was used to measure ocular motility in the horizontal and vertical planes from two modified Hart charts [30].

Accommodation was measured as the number of letters read from near and far chart in one minute, kept at a distance of 0.15 m and 6 m respectively.

Batting performance was assessed as the batting average from five matches played before and five matches after training [4].

TRAINING PROGRAM

All training sessions were supervised by the club level cricket coach (Certified by Board of Cricket Control in India). All the three groups participated in equal number of practice sessions (batting practice, catching practice and fielding drills) as their daily routine.

The subjects in the experimental group were given visual training exercises [23], for 6 weeks, 3 days a week. Each session was of 30 minutes' duration. The exercises included: swinging ball (Marsden ball) exercises, swinging ball with pointed finger, depth perception training, reaction drills, Hart chart therapy, near and far chart therapy, Juggle stick and vision ring exercises.

The subjects in the placebo group were given simple reading material and they watched televised cricket matches (Twenty 20 World Cup), for 6 weeks during the study period, while the subjects in the control group only underwent daily practice sessions like the other two groups.

STATISTICAL ANALYSIS

The data were statistically analyzed using the Statistical Package for Social Sciences (SPSS)/14.0. (Copyright © SPSS Inc.) Statistical tests used in the present study were paired and unpaired t-test, one-way ANOVA and multiple range Scheffe's test.

RESULTS

VISUAL VARIABLES

Descriptive statistics (Mean, Standard Deviation) of all the visual skills tested (reaction time, depth perception, saccadic eye movements and accommodation) is shown in Table 1.

Table 1. Descriptive statistics (mean \pm standard deviation) of visual skills.

Visual Skills	Experimental Group			Placebo Group			Control		
	Pre-test (Mean \pm SD)	Post-test (Mean \pm SD)	t-value	Pre-test (Mean \pm SD)	Post-test (Mean \pm SD)	t-value	Pre-test (Mean \pm SD)	Post-test (Mean \pm SD)	t-value
Reaction Time									
<i>Right</i>	0.242 \pm 0.025	0.230 \pm 0.021	4.307**	0.250 \pm 0.024	0.244 \pm 0.023	1.221NS	0.250 \pm 0.019	0.245 \pm 0.020	0.914NS
<i>Left</i>	0.226 \pm 0.017	0.217 \pm 0.016	3.728**	0.224 \pm 0.023	0.222 \pm 0.023	1.500NS	0.232 \pm 0.017	0.230 \pm 0.017	1.112NS
Movement Time									
<i>Right</i>	0.175 \pm 0.023	0.166 \pm 0.022	4.040**	0.186 \pm 0.036	0.184 \pm 0.035	2.851*	0.184 \pm 0.018	0.183 \pm 0.018	2.252*
<i>Left</i>	0.195 \pm 0.029	0.186 \pm 0.026	3.671**	0.186 \pm 0.019	0.184 \pm 0.019	2.228*	0.189 \pm 0.018	0.189 \pm 0.019	0.728NS
Ocular Motility									
<i>Horizontal</i>	27.12 \pm 5	33.2 \pm 2.8	16.112***	30.1 \pm 3.1	31.0 \pm 3.4	2.250*	29.1 \pm 2.1	29.9 \pm 2.1	2.012*
<i>Vertical</i>	27.5 \pm 2.3	31.6 \pm 2.4	11.781***	28.5 \pm 2.3	29.5 \pm 2.6	2.212*	27.5 \pm 3.2	28.3 \pm 1.2	2.115*
<i>Accommodation</i>	30.7 \pm 2.1	36.8 \pm 2.7	14.992**	32.2 \pm 3.0	32.6 \pm 2.6	1.078NS	31 \pm 2.2	31.9 \pm 2.6	1.062NS
<i>Depth perception</i>	5.9 \pm 2.1	3.9 \pm 1.5	5.655**	5.3 \pm 1.8	5.1 \pm 1.9	3.498*	5.2 \pm 1.3	5.1 \pm 1.4	3.322*

*** Significant $p < 0.001$, ** significant $p < 0.01$, * significant $p < 0.05$
NS= non significant

The comparison of pre- to post- test results of reaction time on the right side shows that the experimental group ($t=4.307$, $p < 0.01$) was significantly quicker as compared to the placebo group ($t=1.221$, $p > 0.05$) and the control group ($t=0.914$, $p > 0.05$). Similar results were observed on the left side as the experimental group ($t=3.728$, $p < 0.01$) was better than the placebo ($t=1.500$, $p > 0.05$) and the control group ($t=1.112$, $p > 0.05$). The results also showed quicker movement time on the right side for the experimental group ($t=4.040$, $p < 0.01$) as compared to the placebo ($t=2.851$, $p < 0.05$) and the control group ($t=2.252$, $p < 0.05$). On the left side the experimental group ($t=3.671$, $p < 0.01$) had better movement time than the placebo ($t=2.228$, $p < 0.05$) and the control group ($t=0.728$, $p > 0.05$).

The pre- to post- test data analysis using paired t test reveals statistically significant improvement in depth perception ability for the experimental group ($t=5.655$, $p < 0.01$), compared to the placebo ($t=3.498$, $p < 0.05$) and the control group ($t=3.322$, $p < 0.05$).

Pre- to post- training improvement in accommodation was apparent for the experimental group ($t=14.992$, $p < 0.001$) compared with non significant improvement in the placebo ($t=1.078$, $p > 0.05$) and the control group ($t=1.062$, $p > 0.05$).

The number of letters read from modified Hart charts on the horizontal saccade was significantly higher for the experimental group ($t=16.112$, $p < 0.001$) than the placebo ($t=2.250$, $p < 0.05$) and the control group ($t=2.012$, $p < 0.05$), clearly indicating superior eye movement skills for the experimental group following six weeks of visual training. Similarly on the vertical saccade the experimental group ($t=11.781$, $p < 0.001$) was better than the placebo ($t=2.212$, $p < 0.05$) and the control group ($t=2.115$, $p < 0.05$).

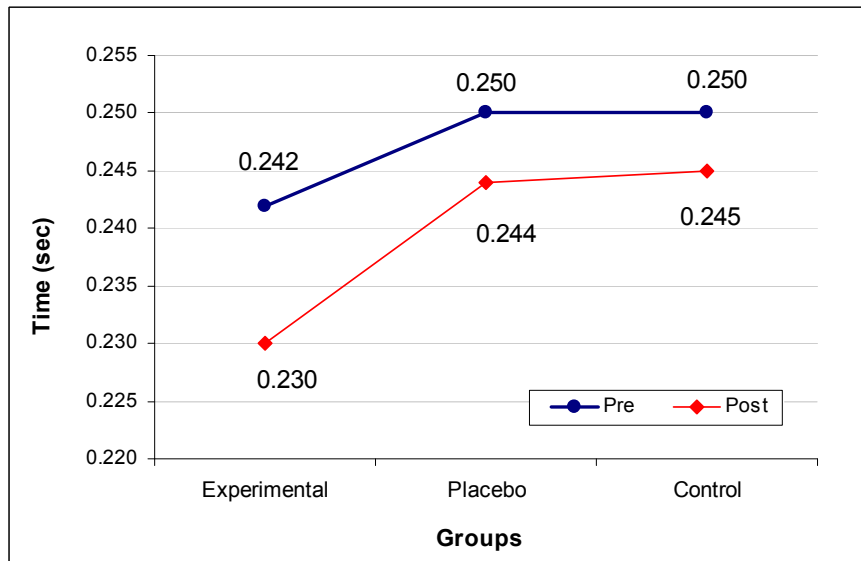
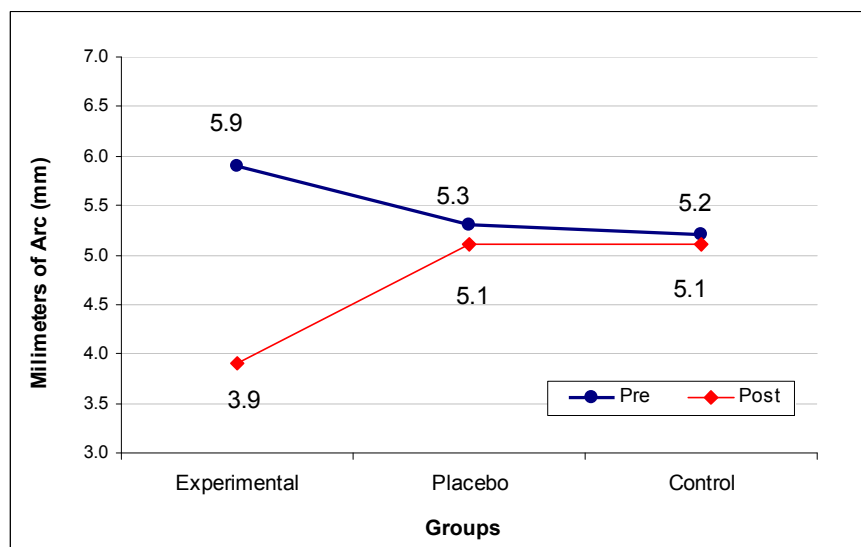
BATTING PERFORMANCE

The descriptive statistics (mean, standard deviation) of batting performance for all three groups is shown in Table 2. The pre- to post- training data analysis indicates significant improvement in batting average for the experimental group ($t=8.252$, $p < 0.001$) compared to the placebo ($t=2.204$, $p < 0.05$) and the control group ($t=2.257$, $p < 0.05$). The results of post training one way ANOVA reveal statistically significant differences in batting performance between the groups ($F=53.11$, $p < 0.05$). Post hoc Multiple range Scheffe's test revealed higher gains in the batting average in the experimental group ($p < 0.05$) when compared either with the placebo or the control group.

Table 2. Descriptive statistics for the batting average

Group	Pre-test (Mean \pm SD)	Post-test (Mean \pm SD)	t Value
Experimental	16.52 \pm 7.24	20.89 \pm 7.96	8.252***
Placebo	17.80 \pm 7.77	18.33 \pm 7.79	2.204*
Control	16.42 \pm 6.12	17.09 \pm 5.68	2.257*

*** Significant $p < 0.001$, * significant $p < 0.05$, SD= standard deviation.

**Figure 1.** Pre- to post- test comparison of the right side reaction time.**Figure 2.** Intragroup comparison of depth perception.

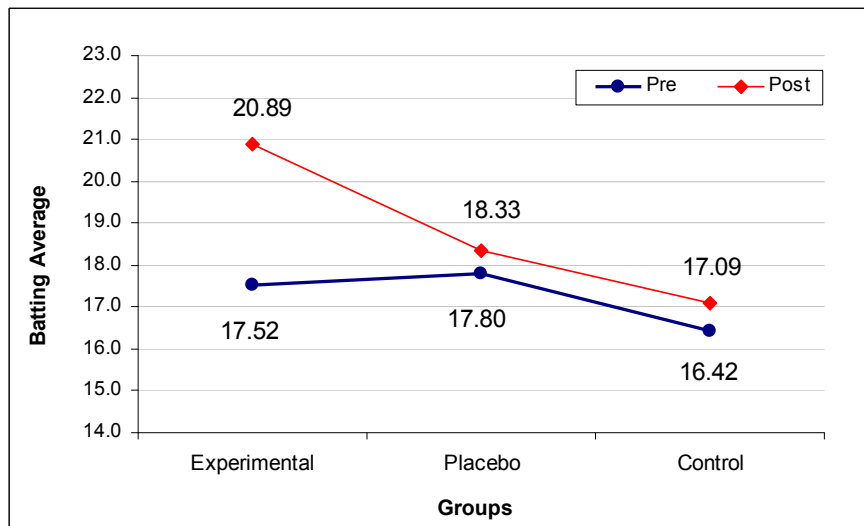


Figure 3. Intragroup comparison of Batting Performance.

DISCUSSION

With reference to the relationship between visual training and visual skills improvement, the descriptive statistics shows a higher increment in all visual skills tested in the experimental group. However, no significant improvement for the placebo or the control group was observed. These findings are consistent with the literature review by Cohan [10], which revealed that a constructive visual training program improves the basic visual skills in athletes. Several types of eye movements are used to view moving objects and are important to understand what events in sports may and may not be seen [16]. When the batsman plays a shot such as pull, hook, square cut or drive, he must judge the horizontal (speed) and the vertical (bounce) position of the ball within a few milliseconds and also at the same time needs to view the gaps to hit the ball, thus stating importance of saccades in cricket. The results of our study showed improvement in the horizontal and vertical saccade in the experimental group ($p < 0.001$). Saccades can reposition eyes requiring velocities exceeding $700^\circ/\text{sec}$. [7]. The eye movements of athletes have been measured to determine visual search strategies used in sports [17]. The assumption is that when a performer looks or fixates the eyes, information is gathered, which could be the swing of the bowler's arm, the grip on the ball and the time of release. This helps the batsman in positioning himself to face a particular delivery. Research has also shown that different head or eye movement strategies are used in fast ball sports [19].

The results of the present study showed statistically significant improvement in movement time for all groups. In terms of the extent of improvement, the experimental group ($p < 0.01$) excelled the placebo ($p < 0.05$) and the control group ($p < 0.05$). This result indicates that regular motor practice could improve player's reactivity. It also supports the view that depending on particular sport a specialization of visual system is possible. These findings are consistent with the work of De Teresa [11], which showed that specialization of the visual system occurs with the nature of a particular sport. In our study we also found quicker reaction time in the experimental group ($p < 0.01$) whereas no such improvement in the placebo and the control group was observed. The ability to focus on a target quickly and accurately is essential in making good contact between the bat and the ball. The present study showed significant improvement in accommodation facility for the experimental group ($p < 0.001$) compared with the other two groups.

The results of the study led us to consider possible causal relationship between visual skills improvement and batting performance, which demonstrates transference of visual skills into performance.

The experimental group ($p < 0.001$) showed significant improvement in batting performance as compared to the placebo and the control group. According to the fundamental principle of specificity, this improvement can be attributed to visual training, as in this study those visual skills that are critical for cricket batting performance were trained. It is important to note that none of the players involved in this study had any previous experience of specific visual training; these visual skills would have been improved by constructive visual training program and would not just develop automatically. Also the present

study excluded psychological factors such as motivation, knowledge about sport, or positive feedback. The notable aspect of this study was that the placebo group ($p < 0.05$) and even the control group ($p < 0.05$) showed some improvement in batting performance, but no improvement was seen in visual skills. The explanation to this could be the “practice effect”, because all groups underwent regular cricket practice sessions during the study period. The results of this study are supported by the work of West and Bressan [29], who indicated positive effect on the performance of cricketers to judge the length of ball after a specific visual training program. The main reason for the average performance for the placebo and the control group could be the lack of attention given to developing important visual skills. The short saccadic latencies distinguish a good batsman from poor [18]. Good balance, footwork, anticipation, and eye-hand co-ordination constitute batting expertise. Vision steers and guides body movements. Similarly, vestibulo-ocular movements co-ordinate eyes with head motion and assist in balance. This may explain why the experimental group outperformed the other two groups.

It should hold true that if the visual system is at a higher level, the overall performance of the player will be at a higher level as well.

CONCLUSION

It can be concluded that the visual skills training program improves the basic visual skills such as reaction time, depth perception, saccadic eye movements and accommodation facility of the cricketers, which demonstrates transference in batting performance

PRACTICAL APPLICATION

Vision training is a new concept, which is like strength training where specific visual skills can be improved by isolating and training them separately. This is especially rewarding when athletes' performance reaches its threshold and further enhancement could be achieved by vision training.

ACKNOWLEDGEMENTS

The authors would like to thank the subjects for their participation in the study.

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