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THE EFFICACY OF THE *EYETHINKSPORT* TRAINING SOFTWARE PROGRAMME ON SOUTH AFRICAN HIGH SCHOOL CRICKETERS

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ABSTRACT

The issue of enhancing an already superior visual system in elite athletes has led to several investigations dealing with intervention programmes designed to enhance visual performance. The influence of visual skills enhancement programmes has been investigated (Coffey & Reichow, 1990; Calder, 2005; Love, Kluka, & Young, 2006; Kluka & Love, 2006). Researchers (Kluka & Love, 2006; Kluka, Love, Covington, Bristow, & Allison, 2000) have reported that elite athletes, when compared to nonathletes, have superior visual abilities, measured through contrast sensitivity function, peripheral vision, visual reaction time, static visual acuity, eye movements, visual concentration, visual recognition and static/dynamic balance. Practical limitations, however, involves applicability to athletes. Where geographical location is considered, access to such training is a factor. A software programme, *EyeThinkSport* (Calder, 2006), was developed as an internet-based, self-administered intervention. Accessed through a personal computer with an internet link, the programme was designed to improve athlete's visual abilities and decision making. The aim of this investigation was to determine the efficacy of the *EyeThinkSport* visual training software programme on selected cricket athletes at high school club level. Thirty high school level (aged 13 – 19) cricket players participated. Each player had at least 3 years of cricket playing experience. Participants were divided into 2 groups (E=15) and (C=15). Four phases of assessment were involved: (1) Series of preliminary visual assessments to establish testing protocol; (2) Pre-training programme assessment (pretest) using six different visual skills tests and five different cricket-specific skill tests (baseline data); (3) Three-week training programme using the *EyeThinkSport* software programme or a placebo; (4) Post training assessment (posttest) using 6 visual and 5 cricket-specific tests. All outcome variables were analyzed using a RM-ANOVA (group X time). Where significant interaction ($p<0.05$) effects were found, post-hoc analyses were performed (Tukey's HSD). In all tests involving visual skills, E performances showed greater improvement when compared to C performances. The efficacy of the *EyeThinkSport* visual training software programme led to significant improvements in the performance of athletes in E in almost all visual skills. In contrast, there was minimal to moderate improvement in all tests with the exception of the horizontal and vertical saccades in C. It was confirmed that the *EyeThinkSport* visual training software programme is suitable to use in the enhancement of selected visual and sport-specific skills in high school cricketers.

Key words: Cricket athletes; visual abilities; visual awareness training; decision making.

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INTRODUCTION

The issue of enhancing an already superior visual system in elite athletes has led to several investigations dealing with strategies and intervention programmes designed to enhance visual performance in athletes at all levels.

Subsequently, the influence of visual skills enhancement programmes on the performance of athletes has been investigated (Coffey & Reichow, 1990; Kluka, Love, Kuhlman, Hammack, & Wesson, 1996; Calder, 2005; Love, Kluka, & Young, 2006; Kluka & Love, 2006). Researchers (Kluka & Love, 2006; Kluka, Love, Covington, Bristow, & Allison, 2000; Coffey & Reichow, 1990) have reported that elite athletes, when compared to nonathletes, have superior visual abilities, as has been measured through contrast sensitivity function, peripheral vision, visual reaction time, static visual acuity, eye movements, visual concentration, visual recognition and static and dynamic balance. These studies examined the effects of structured visual skills enhancement programmes on athlete visual skills performance.

Housner and French (1994) identified transference of visual skills and decision making experiences from practice to game performance as a critical challenge. Leviton (1992) suggested that players use eye exercises to improve the skills of relaxation, focus, tracking, and fusion in order to enhance performance. Suggested strategies to include in an intervention programme were trampoline bouncing, dynamic balance experiences, and varying body and head positions while performing physical activities.

Kluka et al. (1996) showed that visual skills could be enhanced through the use of a battery of sports vision tests and a program of visual skills intervention. Thirty female collegiate volleyball athletes participated in the study. Significant differences in pre- and post-test measurements were found in contrast sensitivity function, stereopsis, lateral and vertical phorias, saccades, and smooth pursuit movements when compared to a control group. The investigators, however, did not assess on-court performance.

Calder (2005) carried these types of studies one step further. The performance of 29 elite women field hockey players in four specific visual skills and 22 hockey skills after a 4-week visual skill enhancement programme was evaluated. They were divided into three groups:

those who received no visual skills training, those who had visual skills training only, and those who had visual and specific visual awareness training. The athletes receiving both visual skills training and specific visual awareness training improved in 12 of 22 hockey skills assessed. Those athletes receiving only vision training showed improvement in only 2 of the 22 hockey skills tested. Those athletes receiving no visual training or specific visual awareness training showed no significant improvement on any of the hockey skill tests.

A practical limitation of all of these investigations involves applicability to teams and individuals. The difficulty in replication for large teams or teams where geographical location is a consideration, involves access to such training.

In response to this limitation, a novel software programme, *EyeThinkSport* (Calder, 2006), was developed as an internet-based, self-administered visual training intervention. This programme, accessed through a personal computer with an internet link, was designed to improve the athletes' visual abilities and decision making time.

AIM

The aim of this investigation was to evaluate the efficacy of the *EyeThinkSport* visual training software programme on cricketers. A group of high school level club players was assessed using a series of 6 standardized visual tests and 6 cricket-specific function tests, prior to and after a 3-week period of training with the computer programme. It was hypothesized that the *EyeThinkSport* training programme would improve performance in visual assessments and cricket-specific skills tests (experimental group) when compared with cricket training using a placebo (control group).

METHODS

A group of 30 high school level cricket players participated in the investigation. Aged between 13 and 19, each player had a minimum of 3 years of cricket playing experience. All players represented the same school and were members of the first or second team. The participants were divided into 2 groups (n = 15) and were matched for bowlers and batsmen as well as for first and second team players.

Four phases of assessment were involved in this investigation:

(1) Series of preliminary visual assessments was conducted to establish testing protocol.

(2) A pre-training programme assessment (pretest) was conducted using six different visual skills tests and five different cricket-specific skill tests. The results of this assessment served as baseline data with which to compare the effects of the training programme.

(3) A 3-week training programme using the *EyeThinkSport* software programme or a placebo training programme was implemented.

(4) A post training assessment (post test) was conducted using the 6 visual and 5 cricket-specific tests.

(1) Preliminary Vision Assessments - Each player performed the following 6 visual skills tests over a period of 3 days, twice daily, leading up to the actual test day. This provided each player familiarity with each of the test protocols.

1. Accommodative Flexibility (F1)

Participants were tested using the Snellen Near Chart at 40 cm, focusing on the 20/20 line through +/- 2.00 lenses (flippers). They were timed for 60 s (to allow for fatigue) focusing the +2.00 and the -2.00 lenses. Focusing both the + and the – constituted 1 cycle; the number of cycles per 60 s was recorded.

2. Horizontal Saccades (HS)

Participants tested at arm's length with an X-chart (adapted from the Hart Chart, 2000), 26 rows of letters 50 cm apart. Time to complete the entire chart and the number of errors were recorded for each athlete (Eye Jumps and Eye Jump Faults).

3. Vertical Saccades (VS)

The same chart and procedure used for HS were used. To achieve this, the chart was turned vertically (Eye Jumps and Eye Jump Faults).

4. Rotational Skill (Rt)

Participants were tested at arm's length from a disk rotating at 33 RPM on a standard turntable. The disk contained 26 letters of the alphabet randomly arranged around the circumference of the disk. The time for participants to locate letters "A" through "J" in sequence was recorded. The athlete pointed to the letter on the rotating disc with a pointer (Eye Tram, Eye Trac).

1. Depth Perception (DP)

Participants were made to wear specially designed sets of glasses as they looked at a chart displaying nine grids of small blocks. In each grid, one block appeared 3-dimensional. The athlete was required to identify the block (DP-Time).

2. SVT Board Performance (SVT)

This apparatus provides two subsets of information relative to peripheral awareness: proaction and reaction. Participants stood 30 cm from a board suspended against a wall. The board, measuring 1.2 X 1 m, consists of a grid of lights which is programmed to flash in a defined sequence. There were two subsets of protocols that were used for testing.

6.1 The pre-programmed sequence of lights was located at the edges of the board; the lights flashed in a defined sequence. Each athlete was required to stare at a marker in the center of the board and to hit a series of 24 flashing lights. There were 2 tests for this exercise – in the proactive mode (PA PRO), the light switched off only after it had been hit. As a result, the measured outcome for the test was the total time take to complete the test, since all lights must be hit in order for the test to be completed. In the reactive mode (PA REA), a total of 24 lights would flash for 0.5 s each. The athlete was required to hit as many lights as possible. The performance outcome for this test is the number of lights accurately hit.

6.2 Eye-Hand Coordination

The assessment of eye-hand coordination using the SVT Board was similar to the protocol used for peripheral vision, but the lights were programmed to flash on at any point on the board (as opposed to the periphery). As with the peripheral vision assessment, there is a proactive mode where athletes must hit a light before it switches off and the next one turns on; in the reactive mode (REA 30.5, 30.4, 60.5, 60.4), lights remain on for 0.5 s before the next light flashes. Scores are determined as total time and total accuracy for the proactive and reactive modes, respectively.

(2) Pre-training testing protocol

For the pre-training testing protocol, all participants were assessed on the previously defined six visual performance tests.

This was followed by a series of cricket-specific testing protocols. For these tests, data were collected, stored and used for analysis, and then compared to the results obtained from the post-training testing protocols.

Cricket-specific testing protocols

Each player performed five sport-specific tests, designed to assess skilled performance in response to visual cues. These included eye-hand coordination, reaction time, throwing accuracy, and depth perception. The following five tests were performed:

1. Reaction time in catching

Participants stood 2 m from a net (Crazy Catch), with the researcher standing 1 m further back. The net (1 m X 1 m) was tilted at a 10-degree angle. The researcher threw the ball over the athlete's shoulder. The athlete was required to catch the ball as it rebounded. The net was designed to return the ball randomly. Each athlete received 20 throws. Catching performance was recorded.

2. Speed and accuracy of catching

The athlete stood 2 m from a net and was required to throw and catch the ball. The number of completed catches in 1 minute was recorded (Eye Speed).

3. Peripheral awareness and catching ability

In a crouched position, the athlete looked at a point on the ground 2 m away. The researcher, standing directly in front, dropped a ball at arm's length, on either side of the athlete. A random order for each athlete was determined and used to receive 20 balls. The number of completed catches was recorded.

4. Throwing accuracy - direction

The athlete stood 20 m from a target consisting of nine stumps pegged to the ground, 10 cm apart. Athletes were asked to aim for the middle stump (#5). The number of direct hits was recorded, with 5 points awarded for the middle stump strike, 4 for stumps 4 or 6, 3 for stumps on the outside, and 1 awarded for striking stumps 1 or 9. Each athlete received 20 throws, with a maximum score of 100 (Direction, pre-direction, post-direction). Table 1 displays the relationship of throwing accuracy to point value.

Table 1: Relationship of throwing accuracy to point Value

Stump	1	2	3	4	5	6	7	8	9
Points	1	2	3	4	5	4	3	2	1

5. Throwing accuracy – distance

This test was measured simultaneously with throwing accuracy – direction. A 1m area was marked on the ground from the nine stumps. Athletes were asked to aim for the middle stump; the ball had to land in the marked area. Both direction and distance (Lengthpre, Lengthpost) of throw were assessed. Athletes received 20 throws with a score of 20 possible striking the target.

(3) Training period

For 3 weeks the total group was divided into two groups of 15. One group, the control group (CON), received 3 weeks of regular cricket training plus 3 sessions per week on the SVT board (placebo), which is designed to assess and train peripheral vision, reaction time and eye-hand coordination. The other group, the experimental group (EXP), performed regular cricket training and 3 sessions per week on the *EyeThinkSport* software program, which is specifically designed to train visual performance, including peripheral vision, reaction time and eye-hand coordination. By allowing the CON group to perform the SVT tests, the aim is to establish whether the *EyeThinkSport* programme improves visual skill performance and cricket-specific skilled performance more effectively than regular practice using the specific visual skills using the SVT board.

Both groups performed a total of 12 training sessions, divided into 3 sessions per week for 4 weeks. The *EyeThinkSport* sessions were supervised for the first week, after which the athletes completed the remaining sessions on their own. The software is constructed to detect use, which allows investigators to monitor the progress of the athlete and the use of the software. In the event that an athlete skipped a session, that training session was made up the following day, supervised by an investigator. The SVT sessions were supervised by a qualified technician who recorded each athlete's performance during the 3-week training period.

(4) Post-training testing protocols

Upon completion of the training programme, all 30 athletes were again assessed on the series of 6 visual assessments and 5 cricket-specific tests previously described. The results from these tests were compared against those from the pre-training results to determine whether the software programme resulted in improved visual and cricket-specific

Statistical analysis was performed using the SPSS 10.0 Statistical Software package. Outcome variables for the visual skills tests include accuracy and time taken to complete the test. Data were presented as means and standard deviations. All outcome variables were analyzed using a repeated measures analysis of variance for a group by time interaction. Where significant interaction effects were found, post-hoc analyses were performed using a Tukey's HSD test for pairwise comparisons. Significance was accepted at $p < 0.05$.

RESULTS AND DISCUSSION

In order to better understand the results, it is important to establish the context of each of the evaluations in terms of:

> flexibility, the higher the score from zero the better;
> depth perception, the higher the score from zero the better;
> depth perception time, the lower the score to zero, the better;
> eye jumps, the lower the time to zero the better;
> tracking, the lower the time to zero the better;
> speed, the higher the score from zero the better;
> reaction, the higher the percentage from zero the better; and
> proaction, the lower the time to zero the better.

In each of the figures, arrows indicate the directionality of the pre- and post-test results as is indicated in the paragraph above. Table 2 provides detailed descriptive statistics of the variables, including minimums, maximums, means and standard deviations. From observation of means and standard deviations on ANOVA results, it is apparent that both the experimental and the control groups were similar in pre-test scores. It is also apparent that each group was fairly homogeneous to the other at the onset of the research.

Table 3 displays the results of a 2 X 2 repeated measures ANOVA by group and by time. Of the 19 variables measured, 18 were identified to have statistically significant differences from pre-test to post-test, 13 involved visual skills, and six involved sport-specific skills.

Table 2: Descriptive statistics of experimental and control group variables

Group	Variable	Minimum	Maximum	Mean	SD
EXP CON	Age	13.000 14.000	18.000 18.000	15.800 15.800	1.146 1.474
EXP CON	Field Score	2.000 2.000	4.000 4.000	3.000 3.067	0.535 0.594
EXP CON	Flexibility Pre	18.000 22.000	38.000 38.000	28.133 29.867	6.022 5.097
EXP CON	Flexibility Post	30.000 12.000	52.000 40.000	39.000 29.867	5.169 7.070
EXP CON	Dp Pre	3.000 5.000	9.000 9.000	8.000 8.067	1.733 1.335
EXP CON	Dp Post	6.000 5.000	9.000 9.000	8.733 8.533	0.799 1.126
EXP CON	Dp Time Pre	0.040 0.070	0.290 0.250	0.159 0.153	0.008 0.005
EXP CON	Dp Time Post	0.030 0.060	0.190 0.260	0.101 0.135	0.005 0.005
EXP CON	Eyejump Pre	0.230 0.250	0.600 0.430	0.385 0.325	0.010 0.006
EXP CON	Eyejump Post	0.200 0.240	0.500 0.420	0.316 0.320	0.009 0.006
EXP CON	Ejfault Pre	0.000 0.000	20.000 17000	4.200 2.200	6.213 4.769
EXP CON	Ejfault Post	0.000 0.000	0.000 14.000	0.000 2.733	0.000 4.527
EXP CON	Eyetram Pre	0.320 0.310	0.810 0.670	0.502 0.481	0.130 0.103
EXP CON	Eyetram Post	0.200 0.310	0.450 0.830	0.313 0.481	0.007 0.126
EXP CON	Eyetrac Pre	0.210 0.230	0.720 0.630	0.411 0.353	0.130 0.108
EXP CON	Eyetrac Post	0.150 0.270	0.380 0.460	0.292 0.355	0.006 0.005
EXP CON	Eyespeed Pre	5.000 4.000	11.000 12.000	7.333 8.667	1.877 1.952
EXP CON	Eyespeed Post	8.000 7.000	12.000 12.000	10.000 9.200	1.134 1.373
EXP CON	Reac30.4 Pre	0.000 0.000	33.000 30.000	15.533 10.867	11.753 7.800
EXP CON	Reac30.4 Post	10.000 3.000	70.000 36.000	40.867 14.600	14.535 10.756
EXP CON	Reac30.5 Pre	17.000 10.000	80.000 77.000	52.733 50.867	16.880 15.779
EXP CON	Reac30.5 Post	48.000 13.000	93.000 80.000	72.200 52.067	15.359 16.803
EXP CON	Reac60.5 Pre	40.000 17.000	85.000 50.000	56.800 33.533	14.483 11.904
EXP CON	Reac60.5 Post	18.000 15.000	60.000 56.000	38.400 33.667	11.121 10.550
EXP CON	Reac60.4 Pre	0.000 0.000	13.000 13.000	4.467 4.933	4.257 4.910
EXP CON	Reac60.4 Post	10.000 2.000	410.00 20.00	55.267 7.867	98.782 6.413
EXP CON	Pareaction Pre	0.000 0.000	29.000 25.000	9.733 6.933	8.523 7.421

Table 2 contd.

EXP CON	Pareaction Post	17.000 0.000	48.000 27.00	34.200 11.267	8.898 7.401
EXP CON	Paproaction Pre	0.180 0.220	0.530 0.590	0.247 0.287	0.009 0.009
EXP CON	Paproaction Post	0.120 0.200	0.260 0.480	0.178 0.278	0.004 0.007
EXP CON	Pre120	0.000 0.000	10.000 7.000	3.333 2.533	2.870 2.295
EXP CON	Post120	8.000 0.000	17.000 8.000	11.200 3.533	3.098 2.133
EXP CON	Pre20	12.000 6.000	19.000 17.000	14.667 12.667	2.193 3.016
EXP CON	Post20	18.000 8.000	20.000 18.000	19.200 13.533	0.775 3.091
EXP CON	Pre60	24.000 38.000	58.000 55.000	43.933 45.800	9.410 4.586
EXP CON	Post60	49.000 34.000	78.000 57.000	63.400 46.000	8.339 5.555
EXP CON	Direction Pre	19.000 32.000	73.000 57.000	41.333 43.733	14.735 7.824
EXP CON	Direction Post	46.000 29.000	85.000 51.000	64.267 38.333	11.234 7.316
EXP CON	Length Pre	1.000 1.000	10.000 7.000	4.200 2.800	2.624 1.897
EXP CON	Length Post	7.000 0.000	15.000 6.000	10.867 2.733	2.066 1.710

Table 3: 2 X 2 repeated measures ANOVA by group and time.

Variable	SS	df	MS	F	Significance
Flexibility X Group	2139.501 64.501	1 1	2139.501 64.501	981.373 2.980	.000 * .095
Depth Percept X Group	6765.365 59.581	1 1	6765.365 59.581	355.203 3.128	.000 * .088
DP time X Group	64.958 37.921	1 1	64.958 37.921	7.018 4.097	.013 * .053
Saccades X Group	16197.816 355.311	1 1	16197.816 355.311	637.309 14.413	.000 * .001 *
Saccade Faults X Group	7222.801 236.685	1 1	7222.801 236.685	42.524 1.421	.000 * .245
Track Manual X Group	63315.539 438.183	1 1	63315.539 438.183	528.788 3.660	.000 * .066
Track Comp X Group	34668.806 482.035	1 1	34668.806 482.035	287.704 4.000	.000 * .055
Speed X Group	520.352 378.383	1 1	520.352 378.383	41.729 30.344	.000 * .000 *
Reac 30 (.5) X Group	5066.401 232.765	1 1	5066.401 232.765	18.206 0.836	.000 * .368
Reac 30 (.4) X Group	5.543 208.376	1 1	5.543 208.376	0.685 12.312	.415 .000 *
Reac 60 (.5) X Group	156.237 2222.629	1 1	156.237 2222.629	0,297 4.226	.590 .049 *
Reac 60 (.4) X Group	7223.910 244.895	1 1	7223.910 244.895	43.694 1.481	.000 * .234
PA Reaction X Group	1333.833 1169.095	1 1	1333.833 1169.095	3.008 2.637	.094 .116
PA Proaction X Group	45243.746 253.912	1 1	45243.746 253.912	132.008 0.741	.000 * .397
Catch react X Group	8533.100 6308.298	1 1	8533.100 6308.298	25.780 22.456	.000 * .000 *
Catch proact X Group	2170.302 280.444	1 1	2170.302 280.444	13.745 1.776	.001 * .193
Periph aware X Group	4847.094 4549.190	1 1	4847.094 4549.190	29.840 28.006	.000 * .000 *
Direction X Group	54737.564 512.740	1 1	54737.564 512.740	1162.521 10.890	.000 * .003 *
Length/Distance X Group	10924.636 161.681	1 1	10924.636 161.681	344.476 5.098	.000 * .003 *

*p< .05

Between pre-and post-tests, accommodative flexibility, timed for 60 s, exhibited a significant improvement in the experimental group. Pre- to post-test mean scores was nearly 10 (pre – $\bar{x}$ = 28.133, post – $\bar{x}$ = 39.000). The control group remained virtually unchanged (pre – $\bar{x}$ = 29.867, post – $\bar{x}$ = 29.867). This is not unexpected, as the groups were reasonably homogeneous relative to this visual skill.

The test used to assess depth perception was a closed-ended one. The maximum score on the test was 9. There was, however, a significant improvement in both mean scores in the experimental and control groups. From observation of Figure 2, the experimental group (pre – $\bar{x}$ = 8.00, post – $\bar{x}$ = 8.733) produced greater improvement than the control group (pre – $\bar{x}$ = 8.067, post – $\bar{x}$ = 8.533). The time taken for athletes to articulate the response when determining depth perception is represented in Figure 1.

Mean scores for both groups relative to depth perception were nearly identical in the pre-test, but a significant difference was noted in the experimental group's performance. Their decision making time was substantially reduced compared to that of the control group. The implication from the reduction in time it takes to make a decision could prove quite beneficial when coupled with total reaction time.

In the evaluation of horizontal and vertical saccades, two significant differences were noted, one between the groups, the other within the experimental group. The experimental group performed significantly faster than the control group on the post-test. They also showed the more substantive improvement from pre- to post-tests. Visual search patterns and abilities to scan the environment for meaningful cues were dramatically enhanced.

Relative to horizontal and vertical saccadic errors, again there was a significant improvement in the experimental group. Mean scores decreased by four, while the control group actually experienced an increase in errors. In addition to decrement in time, the experimental group also increased their accuracy.

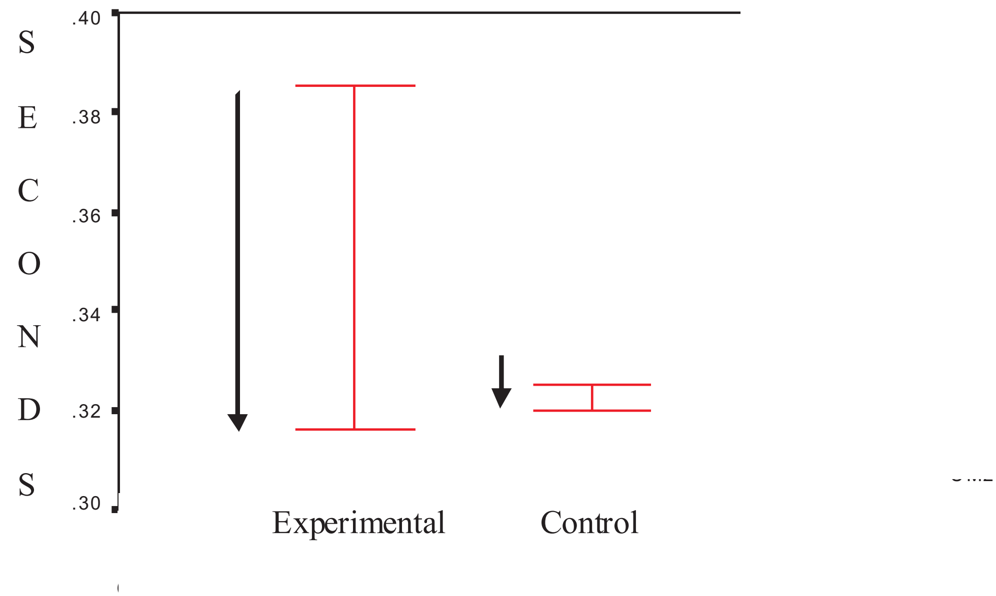

Figure 1: Means of Depth Perception Time Pre- and Post-Test – Experimental and Control Groups.

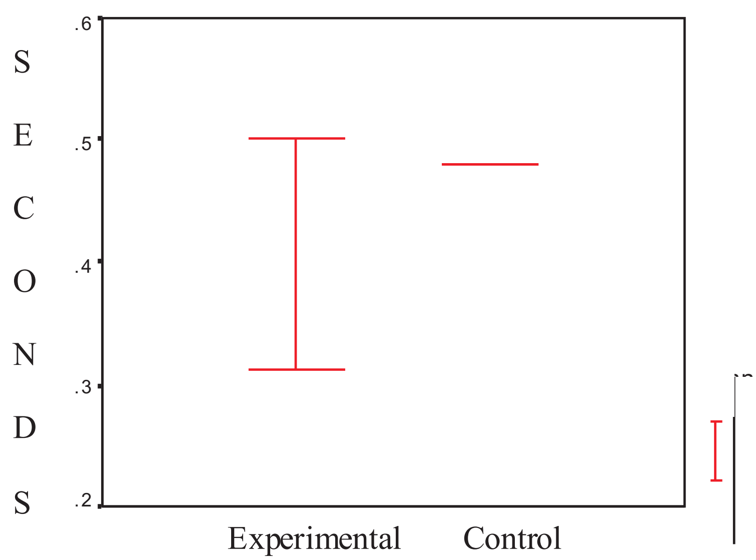

Figure 2: Means of Eye Tracking (Manual) Rotational Skill Pre- and Post-tests – Experimental and Control Groups

The control group, however, accomplished very little decrement in time while increasing the number of errors. The tracking of a ball in cricket appears to be an important ability. Figure 2 represents the results of rotational skills relative to object tracking. The results, reflected by accuracy, showed a significantly lower length of time in identifying objects in the experimental group. The control group remained virtually identical in pre- and post-test performance.

The results of time as related to the rotational skill test also proved significant between groups. There was a significantly greater decrement in time for the experimental group than for the control group. Displayed in ms, the decrement was substantially less from pre- to post-test scores in the control group when compared to the experimental group. When split-second actions are important, the decrement of time related to this skill could prove important to performance success. Using the SVT to evaluate peripheral vision proactively, total time was calculated after all stimuli were contacted. Again listed in ms, the total duration of the experimental group's was significantly reduced, while the control group's total duration was relatively unaffected. The control group's pre- and post-test scores were slower than those of the experimental group's.

In the peripheral awareness reactive portion of evaluation using the SVT, Table 3 reveals no significant difference between groups or within groups. Although both groups improved the percentage of lights accurately hit and, although no statistically significant results were found, it appears that the experimental group improved the percentage of accuracy more than the control group.

Eye-hand coordination was evaluated using the SVT in its reactive mode, where lights remained on for 0.5 s before the next light flashed. As reflected in Table 3, a significant difference was noted in the experimental group. There was also a significant improvement in the experimental group accuracy. The control group showed some improvement, but was not significantly different.

Additionally, there was no significant difference within either group, but a significant difference between groups. Again, the experimental group revealed a substantive difference in post-test scores than the control group. In Figure 3, post-test results reflected a significant difference between the groups. The experimental group exhibited a substantial decrement in time within the group, while the control group remained nearly unchanged. The control group, however, showed less time in the pre- and post-tests than the experimental group.

Relative to Figure 4, the experimental group was shown to have a significant improvement in accuracy scores, while the control group, although pre-testing similarly to the experimental group, displayed negligible post-test differences. Within the parameters of cricket-specific tests, speed and accuracy of ball catching is paramount for performance success. There was a significant difference between groups and within the experimental group. The control group's pre-test scores were initially higher than the experimental group's, but the degree of improvement was far below the experimental group. Table 3 provides additional information on the significant difference found between groups for speed and accuracy of ball catching abilities.

A significant difference in catching performance, represented by the percentage of improvement using the Crazy Catch to evaluate reaction time, was noted between the groups as well as within the experimental group. The control group pre-test scores were lower than the experimental group. There was also substantially less improvement in control group scores. The experimental group score, however, displayed a significant improvement. In the category of peripheral awareness and catching ability, there was a significant difference between group and within experimental group scores. The number of completed catches was significantly less for the control group on both pre- and post-tests. The experimental group displayed a significant improvement in the number of successful catches.

Catching ability in Figure 5 reflects a significant improvement within the experimental group.

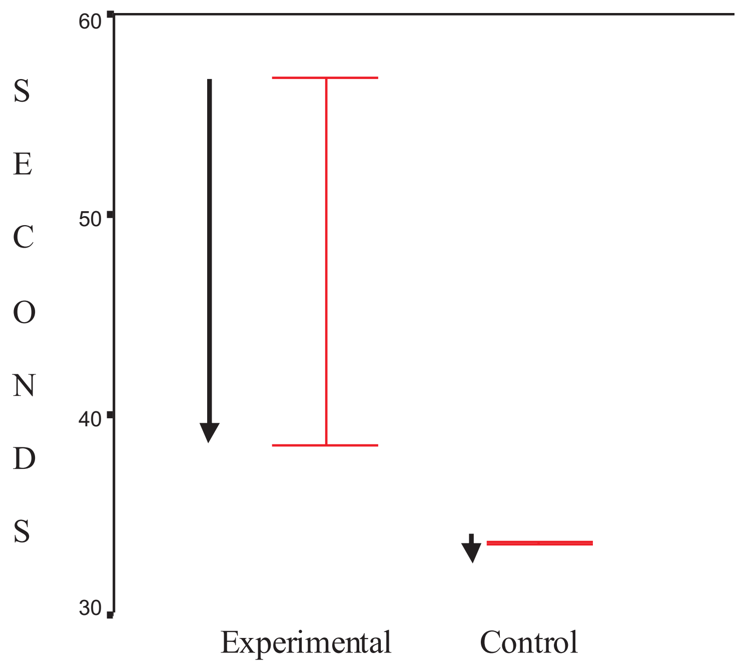

Figure 3: Means of SVT Reaction Time 60 (.5) Pre- and Post-tests – Experimental and Control Groups.

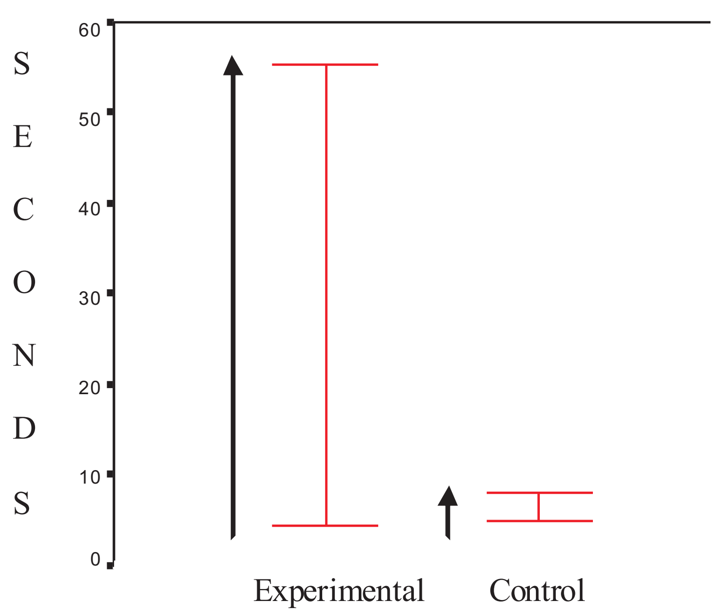

Figure 4: Means of SVT Reaction Time 60 (.4) Pre- and Post-tests of Experimental (1) and Control (2) Groups.

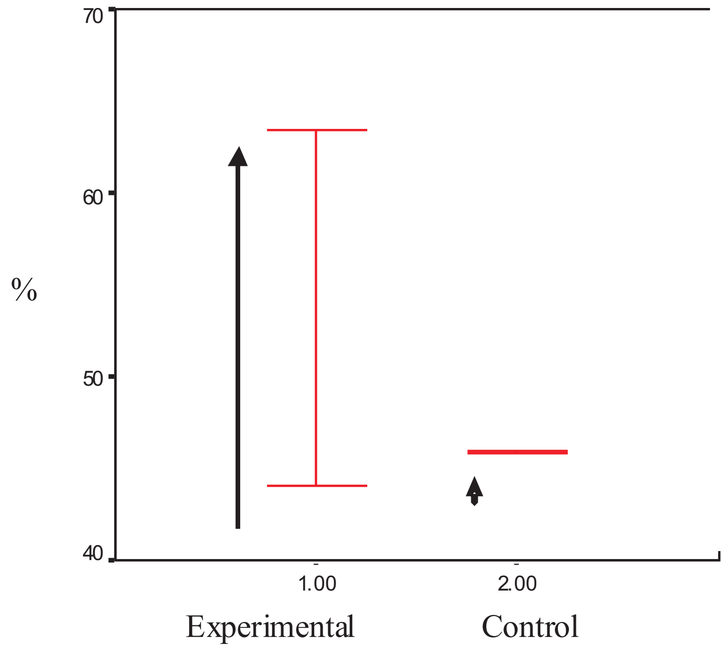

Figure 5: Means of Catching Ability Pre- and Post-tests – Experimental and Control Groups.

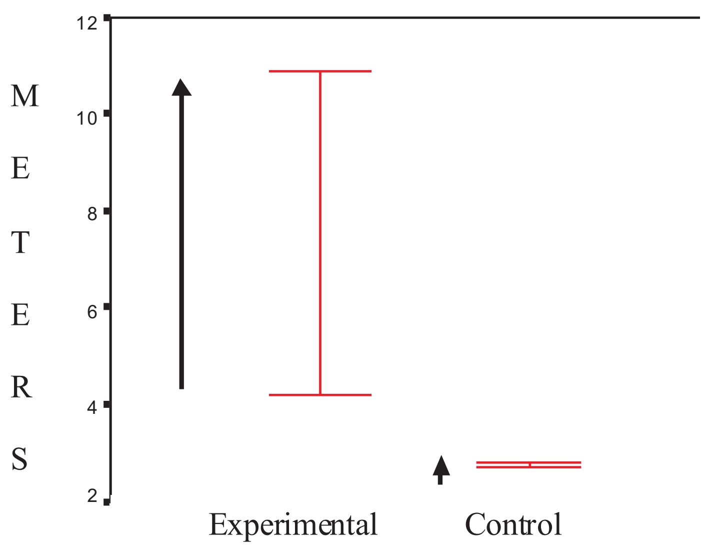

Figure 6: Means of Throwing Accuracy and Distance Pre- and Post-tests – Experimental and Control Groups.

The control group, although displaying a small improvement, was not significantly different from the experimental group.

Significant differences were noted between groups and within the experimental group relative to accuracy and directionality of throwing. The experimental group significantly improved in directionality and accuracy of throwing. The control group, although significantly different from the experimental group in the pre-test, displayed an improvement in scores, but not to the extent that the experimental group improved.

Finally, throwing distance was found to be significantly different between groups and within the experimental group. It appears that the control group barely improved and pre-test scores were significantly lower than the experimental group scores. The experimental group significantly improved in distance thrown.

In summary, in all tests involving visual skills, the experimental group performances showed greater improvement when compared to the control group performances. This is in line with the findings of Kluka, et al. (1996), Calder (2005), and Kluka and Love (2006).

The efficacy of the *EyeThinkSport* visual training software programme led to significant improvements in the performance of athletes in the experimental group in almost all of the visual skill assessments. In contrast, there was minimal to moderate improvement in all tests with the exception of the horizontal and vertical saccades in the control group. Group scores on that variable actually declined from pre- to post-test. When comparing sport-specific skills, there was a noticeable improvement in both groups, but the larger improvement was noted in the experimental group. This finding provides credence for the use of the *EyeThinkSport* visual training software programme to also improve selected cricket-specific skills in cricket. Although the control group exhibited improvement in cricket-specific skills, the improvement was notably less than the experimental. Housner and French (1994) identified transference of visual skills and decision making from practice to game performance as a critical challenge. The *EyeThinkSport* visual training software programme, from the findings of this investigation, can be used as a viable tool for visual skills enhancement in cricket as well as in other sports where there are skills related to those in cricket.

CONCLUSION

The aim of this investigation was to determine the efficacy of the *EyeThinkSport* visual training software programme on selected cricket athletes at high school club level. It was confirmed that the *EyeThinkSport* visual training software programme is suitable to use in the enhancement of selected visual and sport-specific skills in high school cricketers.

It is recommended that the study be replicated using different age groups, different sports, and females so that the efficacy of the *EyeThinkSport* visual training software programme can be generalized to other sports, age groups, and females. It is also recommended that more sport-specific tests be established in order to strengthen the transference of skills from practice to game situation.

REFERENCES

Calder, S. (2005). Enhanced skill performance of field hockey players following a program of visual awareness training. Unpublished doctoral thesis. Cape Town: Sport Science Institute of South Africa.

Coffey, B., & Reichow, A. (1990). Optometric evaluations of the elite athlete: The Pacific Sports Visual Performance Profile. *Problems in Optometry, 1*(2), 32-58.

Housner, L. K., & French, K. E. (1994). Future directions for research on expertise in learning, performance and instruction in sport and physical activity. *Quest, 46,* 241-246.

Kluka, D., & Love, P. (2006). Contrast sensitivity function profiles of volleyball athletes by ability. *International Journal of Volleyball Research, 9*(1), 3-5.

Kluka, D., Love, P., Covington, N. K., Bristow, C., & Allison, R. (2000). The effects of lens color on contrast sensitivity function and batting efficiency in professional women softball athletes. *International Journal of Sports Vision*, *6*(1), 23-28.

Kluka, D., Love, P., Kuhlman, J., Hammack, G., & Wesson, M. (1996). The effects of a visual skills training program upon selected intercollegiate women volleyball athletes. *International Journal of Sports Vision, 2*(1), 12-16.

Leviton, R. (1992). *Seven Steps to Better Vision.* New York: East/West Natural Health Books.

Love, P., Kluka, D., & Young, K. (2006). Effects of a visual skills training program on contrast sensitivity function in selected female intercollegiate volleyball athletes at an HBCU. *International Journal of Volleyball Research, 9*(1), 6-10.