

Effect of a sport vision training programme on the batting performance and predictive judgment of high school level cricketers

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Abstract

Vision plays a crucial role in sport as it is the primary source of external information and provides 85 – 90% of the sensory input during athletic performance (Vickers, 2007; Kluka & Knudson, 1997). The study aimed to investigate the effect of sports vision training on the batting performance and predictive judgement on high school cricket players. The sample included male, high school level cricketers ranging in ages 13 – 18 (14.8 ± 1.2) with at least two years playing experience in cricket. Three high schools were invited to participate in the study. The participants were non-randomly assigned to two groups, 15 participants to a sports vision training group (n=15) and 15 participants to a regular practice group (n=15). Each group was assessed according to the tasks of visual skills, fitness, batting performance, predictive judgement and fitness. The visual skills testing included eye hand coordination, central peripheral awareness and visual response. The fitness assessment was a multistage fitness test. The batting performance test assessed the quality of interception and the predictive judgment assessed the ability to judge the length bowled. The results showed that the intervention group showed significant improvement within the visual skills, batting performance and judgment test conducted ($p < 0.05$), however, these improvements were not statistically different to the control group ($p > 0.05$). Although there were improvements in certain parameters tested, a larger sample may produce better results.

Keywords: Cricket, sports vision training, batting performance, predictive judgement, High School

Introduction

Interceptive actions in sport require players to coordinate their body and simultaneously coordinate an implement to manipulate an object. Timing and the amount of force applied by the player are critical elements of interceptive actions (Davids, Savelsbergh, Bennet & Van der Kamp, 2002). Interceptive actions in fast ball sport place spatio-temporal demands on the players as the speed at which the ball is travelling provides a limited amount of time for the player to process all the important visual information and develop an effective motor response (Erickson, 2007). A link between the visual and neuromuscular systems, as well as prior knowledge about the situation is therefore required for successful execution of an interceptive action (Regan, 1997).

Batting, in cricket, is a complex interceptive skill and batsmen are required to accurately intercept the oncoming ball released at up to 150km/h (Müller & Abernethy, 2012). Batsmen are required to extract information from the bowler's action and early ball flight to judge the ball's length and to ensure quality bat to ball interception (Renshaw & Fairweather, 2000). Batsmen are required to utilise advanced cues from the bowler's action and run-up to attempt to deal with the temporal constraints and determine the future trajectory and direction of the ball bowled (Sarpeshkar & Mann, 2011). Bowlers attempt to create visual misjudgements and challenge the batsmen's skills by creating deviations or changes in ball flight before and after bouncing as well as creating variations in speed and trajectory of the ball (Regan, 2012). It is, therefore, essential that batsmen analyse, interpret and respond to visual stimuli from the bowler and ball to ensure they intercept the oncoming ball with precision, timing and enough force to avoid the interception of fielders (Sarpeshkar & Mann, 2011).

Previous findings have established that expert batsmen have better developed predictive and anticipatory skills (Penrose & Roach, 1995; Renshaw & Fairweather, 2000) and that expert batsmen utilise advanced information and early ball flight information to make a better prediction of ball positioning and importantly a higher quality bat-ball interception (Müller, Abernethy, Reece, Rose, Eid, McBean, Hart & Abreu, 2009). It has also been established that the basic visual skills of cricket players can be improved through different sport vision training techniques (Kruger, Campher & Smit, 2009; Balasaheb, Maman & Sandhu, 2008; Calder & Kluka, 2009). The study, therefore, aimed to examine if sport vision training could lead to an improvement in a batsman's ability to process advanced information from the bowler and early ball flight information quicker and more accurately, to lead ultimately to a correct response in terms of contact and prediction of length. The study examined if the batsmen provided the correct response to the type of length bowled and whether good, bad or no contact was made. The focus of the study was, therefore, to examine if sport vision training techniques could not only lead to an improvement in visual perceptual skills but to an improvement in batting performance by increasing better judgement of length in a natural setting.

Literature review

Visual information is gathered from the sport environment through the use of shifts of gaze that brings visual information onto the retina of the eye and leads to the onset of neural processing (Vickers, 2007). The visual system leads and guides the motor system as players utilise their vision to gather information from the environment to make quick, accurate decisions and guide their movements (Zupan, Arata, Wile & Parker, 2006). According to Wilson and Falkel (2004), the visual system can be improved and trained through sport vision exercises and responds to overload and progressive increases in demands just like any other motor system that uses sports specific drills to improve overall performance. The visual system also performs better once it has been loaded or stressed. The quality of the visual input provided to the athlete can influence how an athlete interprets and responds to information from the environment. The visual input is therefore considered a pivotal element for success in any motor performance (Ferreira, 2003).

Sports vision, which combines motor learning; vision science; biomechanics and its effect on perceptual motor performance (Kluka & Knudson, 1997), is an area coaches are focusing on to try gain a competitive edge over competitors and improve athletes' performances. Thus, cognitive and perceptual abilities have become as important as motor and physiological abilities (Schwab & Memmert, 2012). A new area of focus is the use of a variety of sport vision exercises to improve the visual skills of sports.

Many studies have been conducted on the effect of sport vision training on visual skills of athletes in various sporting domains. The conclusion from these studies is that the basic visual skills can be improved through vision training sports such as **table tennis** (Paul, Biswas & Sandhu, 2011), **rugby** (Du Toit, Kruger, Joubert & Lunskey, 2007; Du Toit, Kruger, Fowler, Govender & Clark, 2010), **tennis** (Maman, Gaurang & Sandhu, 2011; Tsetseli, Malliou, Zetou, Michalopoulou & Kambas, 2010), **netball** (Bressan, 2003) and **field hockey** (Schwab & Memmert, 2012).

Zupan et al. (2006) explained the more visual skills sessions players participates in the more improvement that will occur in their sport vision skills. Zupan et al. (2006) established that in majority of visual skills the best improvements could be seen after 60 sessions. Although these studies have suggested a sport vision training programme can produce improvements in visual skills and performance, Abernethy and Wood (2001) and Wood and Abernethy (1997) argued that generalised visual training programmes do not provide an improvement in basic visual function or motor performance. They explained that expert's advantage exists in their ability to interpret domain specific information to guide their actions. Potgieter and Ferreira (2009) found that there was no significant improvement between the experimental and control group in gymnastic participants after a five week sport vision programme, in terms of the software visual skills of the athletes.

Studies have also examined the effect of visual skill training on the visual skills of cricketers. Research from these studies provides evidence that visual training programmes can lead to an improvement in the visual skills of cricket players (Kruger et al., 2009; Balasaheb et al., 2008; Calder & Kluka, 2009). In a study performed by Kruger et al. (2009) similar results were discovered but no control group was used in their study to compare the improvements. The transfer of visual skill improvement to sports performance is the ultimate goal of researchers. Paul, Biswas and Sandhu (2011) and Maman, Gaurang and Sandhu (2011) indicated that a visual

skills programme resulted in a significant improvement in motor performance tests in the respective sporting domains of table tennis and tennis. Van Velden (2010) and Balasaheb et al. (2008) conducted studies to examine the use of visual skills training to improve batting performance in cricket. Van Velden (2010) utilised a batting performance test and coincident anticipation timing. It must be noted that Van Velden (2010) utilised a bowling machine for assessment of batting performance which removes the naturalistic element from the assessment and could have an impact on the results. Balasaheb et al. (2008) utilised the averages after five batting scores which is similar to a study by Clark, Ellis, Bench, Khoury and Graman (2012) examined the use of vision training to improve batting statistics in baseball. The study examined the batting average of the baseball batsmen over the season and revealed increases in slugging percentage and batting average.

Methodology

Study design

This was a pre- and post- test research design. The study population was a purposive sample, (which is a sample constructed to serve a very specific need or purpose, with the researcher having a specific group in mind) which included male, high school level cricketers ranging in ages 13 – 18, (mean age = 14.8 years, \pm 1.2) with at least two years playing experience in cricket. Three high schools were invited to participate in the study. The sample included thirty cricket players (n=30), with twenty eight right handed batsmen and two left handed batsmen. The participants were non-randomly assigned to two groups, fifteen participants were assigned to a sport vision training group (n=15) and fifteen participants from were assigned to a control group (n=15). Ethical clearance was provided by the University of Johannesburg's Ethics Committee to conduct the study. All participants and their parents provided written consent prior to the commencement of the study and were free to withdraw from the research at any stage of the study.

Intervention

The study followed an 8-week pre-post intervention study. The study consisted of two groups; an experimental and a control group. The two groups each underwent an 8-week programme consisting of two sessions a week lasting approximately 60 to 90 minutes a session. The experimental group maintained their training status (batting, bowling and fielding training) and included sport vision and agility drills in their program. The control group continued with their training status (batting, bowling and fielding training). Each group conducted pre and post testing comprising of three vision tests, a fitness battery of tests, a batting performance test of quality bat ball contact and a judgement of length test. Each participant was administered a questionnaire to gather background information about the participants.

Training groups

Control group

This group practiced cricket specific skills which are skills practised commonly at regular cricket training. This included; batting technical and tactical drills, bowling technical and tactical drills and fielding drills to improve throwing, catching as well as ground fielding. This group did not receive any sports vision or agility training

Sport vision group

The sessions consisted of cricket specific skills and included agility and sport vision drills focusing on the player's "software visual skills" namely the peripheral awareness, eye hand and body coordination and visual response time. The sport vision drills made up 30 minutes of the sessions with a large portion of the sessions focussed on the peripheral awareness of the players. The sessions followed a systematic increase in task difficulty and focussed on loading the visual-motor system. The players were also exposed to deal with a large amount of information at once as well as making the players utilise their central and peripheral vision when performing the drills.

The drills were designed to be implemented in the most "natural" cricket environment as possible. The drills involved a large degree of catching and interception and were similar to the drills used by Du Toit et al. (2007) and Du Toit et al. (2010) in their study on rugby players and visual skills improvement.

Testing Programme

Visual skills testing

The participants were tested using a battery of vision tests to assess their software visual skills (Potgieter & Ferreira, 2009). The Wayne Saccadic Fixator (Wayne Engineering, 8242 N. Christiana Avenue, Kokie, IL 60076) was the instrument used to test eye hand coordination, central peripheral awareness and visual response time

Eye hand coordination

Purpose: Examine how well the eyes and hands work together.

Description of test: The Wayne Saccadic Fixator was placed at eye level with the participant at an arm's length away. The instrument's lights went on randomly for thirty seconds. The participant was able to use both hands and attempted to touch each light that went on. Each light only went off when the participant touched it.

Central peripheral awareness

Purpose: Examine if the participant is able to maintain a central fixation on a target, whilst still be aware what is happening in the peripheral visual field.

Description of test: Central-peripheral awareness was tested in the same way as eye-hand coordination except that the lights went on centrally every second time, followed by a light anywhere in the periphery. The participant had to constantly fixate on the central light, and therefore only see the peripheral lights with their peripheral vision. The participant was allowed to use both hands to touch the lights.

Visual response time

Purpose: Examined how quickly the participant could perceive and respond to a visual stimulus.

Description of test: The horizontal visual response time of the left and right hand of each participant was tested by having them push the lights going on alternatively in the 3 and 9 o'clock positions on the Wayne Saccadic. The quickest time in moving from one position to the

Fitness testing

Fitness testing was done to examine if a change in fitness would have any effect on the participants improvement of batting performance or predictive judgement. The reason for the fitness testing was to test if there was firstly an increase in fitness and secondly if there was an increase did it have an impact as a variable on batting performance, predictive judgement and visual skills.

The multistage fitness test (Leger & Lambert, 1982)

Description of test: The participants were required to run continuously between two lines twenty metres apart, turning when signaled by the recorded beeps. After about one minute, a sound indicates an increase in speed, and the beeps will be closer together. This continues each minute (level). If the line is not reached in time for each beep, the subject has run to the line turn and try to catch up with the pace within two more 'beeps'. Also, if the line is reached before the beep sounds, the subject must wait until the beep sounds. The test is stopped if the subject fails to reach the line (within two metres) for two consecutive runs. The participants level and number of shuttles achieved are recorded when the participant is withdrawn.

Batting performance and predictive judgement task

Purpose: The batting performance and predictive judgement task was to examine the participant's quality of bat-ball interception and judgement of length. The tests were conducted simultaneously, with the results independent of each other.

Description of test: This test was performed to rate the quality of bat ball interception and judgement of length. Each batsman received eighteen balls (three overs) from a bowling machine prior to the batting performance test as a warm up. The bowling machine was set between 100 km/h – 120 km/h. The batsmen's batting performance test was recorded using a Sony HDR CX190E video camera positioned at the bowlers end in line with the stumps, one meter away, on the leg side of the stumps. Each ball bowled was recorded and the data was analysed by two certified and experienced cricket coaches. The two qualified coaches assessed the quality of bat-ball interception as good, bad or if no contact was made. The quality of interception was defined as either good, bad or no contact. According to Müller and Abernethy (2008), good contact is when the ball made contact with the blade of bat, not the handle or gloves, and then travelled in a direction post contact that was consistent with pre-bat contact plane of motion. Bad contact was defined as when the ball made contact with the blade of the bat but the ball deflected and travelled in a different direction to the pre contact motion of the bat. No contact was defined as when the ball did not make contact with the bat at all.

The batsmen were simultaneously assessed as to whether they went back to a ball pitching short or forward to a ball pitching full, therefore if they provided the correct judgement to the type of ball bowled in terms of length. Three sets of different coloured markers were placed on the pitch to mark off a ball pitched full, short or a good length. A Sony HDR CX190E camera was positioned four metres perpendicular to the batsmen at the batsmen's end to analyse the batsmen's predictive judgement skills. A full ball required a definitive forward movement and shift of weight onto the front foot, a short ball required a backward movement and thus a shift of weight onto the back foot. A forward movement to a full ball and backward movement to a short ball were coded as correct.

Each ball was recorded by a research assistant to analyse as to whether it pitched full, good length or short to enable a comparison to be made to the judgement of the batsmen. The same bowlers were used in the pre-and post-test. All bowlers were seam bowlers and were instructed to bowl as they would in a match situation. Each batsmen received deliveries from the prescribed bowlers in no specific order. Markers were set up on the pitch to mark off the side lines; 89 centimetres from the middle stump on the offside and 30.5 centimetres on the leg side. Any ball crossing this line was not counted and was re-bowled by the bowler. All no balls were also not counted and were re-bowled; all tests were conducted on a synthetic cricket pitch.

Results

Visual skills testing

The results from the study indicated that the experimental group displayed a significant improvement in eye hand coordination and central peripheral awareness, whereas the control group had a significant improvement in eye hand coordination and the visual response with the right and left hand. The results from the study also indicate that there was no significant difference between the experimental and the control group with regards to all the visual skills tested $p > 0.05$.

Fitness levels

The fitness levels of both groups did not increase and therefore fitness did not have an impact on the visual skills, batting performance and predictive judgements of the participants.

Batting performance and predictive judgement

The results indicated that the experimental and control group both displayed a significant improvement in the batting performance and the predictive judgement test conducted however, there was no significant difference between the groups $p > 0.05$

Discussion

Vision plays a crucial role in sport as it is the primary source of external information for cricket players. Players utilise the information gathered to make quick decisions and produced accurate movements. Inaccurate information from the visual system could lead to a decrease in motor performance and therefore effective functioning of the visual system is crucial (Vickers, 2007; Kluka & Knudson, 1997; Zupan, et al., 2006). The aim of the study was to investigate the effect

of a sport vision training programme on the visual skills, fitness, batting performance and predicative judgement on an experimental group in comparison to a control group.

Previous studies conducted involving the use of sport vision training programmes on different sporting domains of table tennis, tennis, hockey and rugby (Paul et al., 2011; Maman et al., 2011; Memmert & Schwab, 2012; Du Toit et al., 2007 & Du Toit et al., 2010) indicated that visual skills could be improved significantly in most visual skills tested after a period of sport vision skills training. Cricket studies examining the effect of a sport vision programme on cricket players visual skills performed by Balasaheb et al. (2008), Kruger et al. (2009) and Calder and Kluka (2009) all concluded that a sport vision programme leads to a significant improvement in the majority of the visual skills tested after a sport vision intervention programme. In contrast the results of Abernethy and Wood (2001), Wood and Abernethy (1997) and Potgieter and Ferreira (2009) that sport vision training does not lead to an improvement in software visual skills and basic visual function. The results from this study do not support either research concept fully as the sports vision training did lead to an increase in some visual skills but this was not statistically different from the improvements in the control group.

The batting performance test and predicative judgement test conducted was performed to assess if there was an improvement in motor performance of either group. The transferability of visual skills improvement to motor performance within a specific sporting domain is a crucial area of investigation as the ultimate goal for any athlete is sport expertise or exceptional athletic performance. In studies conducted by Paul et al. (2011) and Maman et al. (2011) it was concluded that a visual skills programme resulted in a significant improvement in motor performance tests in their respective sporting domains of table tennis and tennis. In contrast to these results Van Velden (2010), Wood and Abernethy (1997) and Abernethy and Wood (2001) all concluded that a visual skills programme does not lead to an improvement in motor performance.

The results from the current study indicated that the experimental group did show an improvement which is similar to the results of Paul et al. (2011) and Maman et al. (2011), although the control group also showed an improvement. This leads to the need for further investigation into the transferability of visual skills improvement to sport performance as the research outcomes regarding the transferability of visual skills improvement to motor performance within a specific sporting domain

Conclusion

It could be concluded that the intervention group showed a significant percentage improvement throughout the majority of the tests conducted. There was a percentage change within the visual skills, batting performance and judgement test conducted, however these improvements were not statistically different from the control group.

The results from this study indicate that an improvement in some visual skills, batting performance and predicative judgement can occur following a sport vision programme, however these improvements are also seen within the control group.

It is evident from this study that some visual skills, batting performance and predicative judgement can be improved through a short sport vision training programme, although these

improvements are not statistically different from the control group. Further investigation is required into the use of sports vision training at high school level.

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