Impact of Visual Skills Training on Sports Performance: Current and Future Perspectives

Abstract

Every sport requires a set of visual skills that are critical elements to most sports performance. A considerable debate has taken place concerning the role of vision in sports performance but it is the training of these specific skills that influence to strengthen specific visual abilities resulting in actually improved performance. This article highlights the current perspectives on the importance of visual training on visual skills enhancement leading to an improved performance in sports. It also gives further insights in the need of future longitudinal trials involving athletes from diverse sports as well as recommends visual skills training to be included in the routine training of the athletes at all levels.

Keywords

Eyesight; Sports Performance; Training; Vision Therapy; Visual Skills

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Introduction

Over the years, a large emphasis has been placed upon achieving normal eyesight (20/20) in the ophthalmic community. There is much more to perfect vision than having normal eyesight. While the term "sight" emphasizes the clarity of image on the retina, vision encompasses a broader meaning as the mental process of deriving meaning from what is seen and is the output of visual pathway integrity, visual efficiency and visual information processing. Although, the eyesight plays a critical role in image formation in the retina of the two eyes, the complex process comprising of the relay of the information as well as its processing by the visual and visual association areas of the brain enables one to achieve better vision. Because the brain is dedicated more to vision than all the other senses combined, inefficient use of the visual processes can profoundly affect an individual's potential. A considerable debate has taken place concerning the role of vision in sports performance but it has been well established that the vision is the primary sense responsible for a good athletic performance in sports in the recent years [1-3] and therefore, visual performance factors must be taken into consideration when providing vision care services to the athletic patients. Every sport requires a set of visual skills that are critical elements to most sports performance and it is the training of these specific skills that influence to strengthen specific visual abilities leading to actually improved performance [4].

Vision is the signal that directs the body to respond and provides athletes with the information regarding where and when to perform. If the visual system is not receiving messages accurately or quickly enough, performance may suffer [5]. It is important for visual systems to be functioning at advanced levels because athletic performance can be one of the most rigorous activities for the visual system [6]. Most often, only the ocular health integrity element of the vision is examined through a routine examination by an eye care professional, and so the need for incorporating visual efficiency as well as information processing skills evaluation is looming large. Imagine a cricketer swinging the bat at a white Kookaburra ball delivered at 100 miles per hour at exactly the right moment and at the middle of the bat to hit a maximum and making sure the ball avoids getting to one of the fielders. It is the batsman's vision that guides throughout the process of judging the speed and spatial location of the ball and tracking the ball right onto the bat and hitting the ball efficiently. A set of visual skills are required not only for the batsman but also for all of those trying to catch the ball. For instance, the ability to catch a ball requires continuous convergence of the eyes, assessing the speed of the ball and predicting its path [7]. To actually catch a ball, one must combine the eye's inputs with activation of the body's motor system to get the hands in the correct place. This complex process requires a set of visual-motor skills in the form of depth perception, saccades and pursuits, eye hand co-ordination, vergence, peripheral awareness and visual reaction time. These skills are amenable to training and therefore can be predicted to provide the athletes with a potential advantage over their counterparts. Since, vision resides in the brain, any evaluation of the visual system without considering its effects on cognition and movement, is deemed incomplete. In totality, vision is a learned complex and developed set of functions that involve a multitude of skills and therefore, can be taught through specific training of the visual skills through an individual specific program administered by qualified eye care professionals.

Discussion

The training of the visual skills, also called as vision therapy, can be thought of as physical therapy for the eye and brain. Since "the eyes lead the body" concept was put into perspective by Blantor Collier, a football coach, a greater impetus has been given to understand the impact of visual skills on sports performance

[8]. Vision skills are essential to success in most sports [9,10]. Visual sensory input may account for up to 85-90% of the sensory input an athlete is receiving during an athletic contest. Since, vision is learned; this can be learned well or poorly by the athletes and hence, the training of the visual skills is essential in maintaining a superior performance day in and day out. It is now a no brainer that an athlete with obvious visual deficiencies is expected to improve in affected aspects of sports performance if the visual skills are improved to average performance levels. But the big question is if this holds true for athletes already possessing above average visual skills. A perceptual training program applied to the University of California Riverside (UCR) Baseball Team was not only able to improve their reading of the eye charts but also their batting averages after completing more than two dozen 25-minute vision training sessions using a computer program. Furthermore, the players who didn't receive the training did not show similar improvement. Clark JF et al. [11] in their study, have found marked improvement in the batting averages of the players following six weeks of various kinds of vision training. On one hand, there have been several other studies that have highlighted the positive roles of vision training on sport-specific tasks [12-14] but on the other, there are studies demonstrating no improvement in performance [15,16]. It is important to realize that training of the visual skills following a definite approach is intended to improve these skills with sensory integration and improve the ability to interpret what is seen.

There are many athletes playing in highly competitive leagues across the world who believe that they should be able to do what other athletes are doing but performance differs even though all the athletes put a sheer amount of hard work. Sometimes, just because of some visual skills inefficiency, the athletes are not able to perform to their desired level despite the dedication and meticulous efforts. Wood and Abernethy [16], and Abernethy and Woods [17] have claimed, in their reports, that sports vision training is ineffective because the improved performance achieved after training is a result of test familiarity. However, their sample size was small and they did not evaluate the long term improvements which are attributed to changes in the body, either physical or mental [18]. It is worth highlighting the potential goals vision training is expected to accomplish. Not only the visual inefficiencies are remediated and skills are enhanced but also the visual information processing skills, visual-motor proficiency and cognitive functions are improved. These areas are the key to high level performance in any form of sports and therefore, improvement in these areas as such is critical in achieving a top level performance.

Loran and Griffiths [19] found a significant correlation (p=.01) between the coaches' ranking of their under 14-year old soccer players and overall visual skills. Visual sensitivity in the form of visual acuity and contrast sensitivity are important in judging finely detailed information. This is more evident with a golfer practicing the art of putting who requires resolution of every fine detail. Studies have shown enhancement in both contrast sensitivity and the ability to resolve detail with training [20-22]. The ability to discriminate moving visual information is apparent in all level of sports and dynamic visual acuity has been shown to be improvable with training [23]. Accommodative and vergence facility training help athletes to improve focus and rapidly change eye alignment for different fixation distances often encountered in various sports. Falkowitz and Mendel [24] reported their 11 to 13 year old Little Leaguers, who had better tracking and convergence skills than a comparable sample, were more likely to have higher batting averages; however, a statistical analysis was not reported. Superior binocular depth perception has been demonstrated to be more advantageous to athletes [25]. The eye-hand co-ordination is a critical skill in most outdoor sports that help organize and co-ordinate vision with motor senses. Vogel and Hale found that their subjects between the ages of 8 and 13, who had participated in organized athletics, scored significantly better (p=.0001) on an eye-hand coordination program of the Wayne Saccadic Fixator than children who did not participate in sports [26].

Saccadic and pursuit eye movements [27] as well as speed and accuracy of depth performance [24] are the key skills required for effective performance in sports like table tennis, tennis, badminton to name a few. Often a complex combination of pursuit and saccadic eye movements are required to track an approaching ball. It has previously been reported that the qualities of saccades and pursuits eye movements are superior in athletes compared to non-athletes [26]. These training activities help to make the eye movement performance automatic minimizing the attention required for skilled performance [28]. Lenoir et al. [27] showed that athletes with better depth perception would be more successful at catching compared to athletes with poor depth perception. Trachtman examined ocular motility in 36 Little League boys, ages 10 to 12 years old [26]. He found a coefficient of correlation of +0.40 between two pursuit directions (up/down and side to side) and batting averages at greater than 0.05 level of significance.

Besides these, visual reaction time, spatial localization and speed of recognition are critical skills in many sports, both indoors and outdoors and training these skills is critical for better performance. Several studies investigating the speed of recognition abilities in athletes who play fast ball sports have established that the experienced athletes can evaluate sport-relevant information more rapidly than inexperienced observers [29-31]. As in most outfield sports like soccer, baseball, etc., the processing of information from the peripheral visual field in essential in anticipating the challenge as well as achieving the aim of making a goal or a try. As such, the peripheral awareness is a key skill in the armory for an athlete's sport-specific performance. Results have indicated that the athletes have a larger extent of visual field than non-athletes and a better form recognition at more peripheral locations [32,33]. Also, ocular dominancy is a key measure of performance in sports like shooting. Every person has a dominant eye that processes and transmits information to the brain a few milliseconds faster than the other. The dominant or sighting eye also guides the movement and fixations of the other eye [34].

It is worth mentioning that optimum visual performance is making the appropriate response in the shortest period of time based on the least amount of information, with the least amount of effort, in or out of balance and for extended periods of time. Not much happens in sports until the eyes instruct the hands and the body as to what to do. As pointed out by Softball athlete Lydia Clanton and Dallas Stars' Goaltender Richard Bachman, vision training helped them to perform at top of their levels and it will not be surprising if more athletes follow suit.

Conclusion

There are ample evidences that training of visual skills administered in a definitive approach and on individual basis following particular guidelines can lead to an improved performance in various aspects of sports eventually leading to a top level performance desired by most athletes. As such, it is high time that all the sport authorities realized the importance of vision training which is as important as physical training for better sports performance, if not more. It is recommended that qualified eye care professionals (optometrist or ophthalmologist) with expertise in sports/performance vision be involved as a part of sport-specific performance enhancement team at all levels. It is also imperative to conduct longitudinal trials on a large sample of athletes of various sports to demonstrate enhancement of visual performance on training limiting all confounders.

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