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Visual skills of elite Brazilian football players

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ABSTRACT

Several authors have reported the importance of visual skills (or sports vision) for sport performance, however, little has been investigated about visual skills of football players. Thus, the purpose of the study was to investigate the visual skills of elite Brazilian football players and compare visual skills scores of players from different age groups and different positions. Fifty male elite Brazilian football players from a top football club from the main Brazilian football league (first division) performed the visual skills test using Vizual EdgePerformance Trainer® (VEPT) for the following visual skills: eye alignment, depth perception, convergence, divergence, visual recognition, and visual tracking.No statistical significance was found between the age groups for eye alignment, depth perception, convergence, divergence, visual recognition, and VEPT (combined total score) scores. Conversely, statistical significance was found for visual tracking, in which the Pro (93.4 ± 2.2 %, P=0.05) and U20 (95.2 ± 1.8 %, P=0.00) were significantly better than the U15 (85.9 ± 1.8 %). In addition, the U20 (95.2 ± 1.8 %, P=0.03) was also significantly better than the U17 (87.2 ± 2.1 %). With regards to players of different positions (goalkeepers, defenders, midfielders and forwards), no statistical significance was found for any of the variables tested. In conclusion, the present study reports that the visual skills, more specifically visual tracking, of more developed and experienced elite football players (U20 and main squad) are greater than the visual skills of younger and less experienced elite football players (U15 and U17).

Keywords: Visual skills, Sports Vision, Football, Soccer.

INTRODUCTION

Football, otherwise known as soccer, is without a doubt, the most popular sport in the world [1]. Along with the enormous popularity of football, there has been remarkable expansion of football as a science. As times have evolved, so has the general acceptance of contemporary scientific approaches being utilized during the preparation of football players for competition. Such disciplines include physiology, biomechanics, strength and conditioning, psychology, pedagogy, sociology, and nutrition [2]. In the last couple of decades there has been significant accumulation of scientific data regarding football physiology and medicine [3]. However, little has been investigated about visual skills of football players.

Several authors have reported the importance of visual skills (or sports vision) for sport performance [4-8]. Also, many studies have shown significant differences in visual skills of athletes when compared to non-athletes [4, 9-11]. Regarding the type of sport, the majority of the studies in visual skills were done in baseball [12-15] and volleyball [7, 10, 16-17]. Studies of visual skills in other sports such as tennis, table tennis, cricket, American football, and rugby, can be fairly easily found as well. Nevertheless, very little can be found about visual skills in football, especially for elite players.

The few studies about visual skills done in football refer to goalkeepers [18-20] or referees [21-23]. Other studies, with field players, were focused on kids rather than elite players [24].The research in these studies dealt with perceptual skills, eye-foot coordination or reaction time instead of visual skills [25-30]. The rare studies found with elite football players, investigated visual search (eye movement) instead of visual skills [31-32]. Thus, because of the lack of information on visual skills of elite football players, more studies in the area should be done.

The purpose of the study was to investigate the visual skills of elite Brazilian football players. Further, the study also aimed to compare visual skills scores of different age groups and different playing positions.

MATERIALS AND METHODS

Subjects

Fifty male elite Brazilian football players were tested. All subjects wereunder contract with a top football club from the main Brazilian football league (first division). A minimum of tenplayers were randomly selected from each one of the four age groups. Age groups were (1) U15 (14 and 15 years old), (2) U17 (16 and 17 years old), (3) U20 (18, 19 and 20 years old) and (4) Pro or first squad(players older than 20 years). Further, the subjects were also divided into four different groups according to their field positions: (1) goalkeepers, (2) defenders (centre-backs and full-backs), (3) midfielders, and (4) forwards.

Procedures

All fifty individuals performed the visual skills test using Vizual EdgePerformance Trainer® (VEPT).VEPT is a 3-D computer-based visual skills training program that assesses the following visual skills: eye alignment, depth perception, convergence, divergence, visual recognition, and visual tracking. The VEPT program provided quantitative scores for each one of the visual skills mentioned previously, as well as a combined total VEPT score. The tests consisted of four exercises using 3-D glasses (eye alignment, depth perception, convergence, and divergence) and two exercises without the 3-D glasses (visual recognition and visual tracking). After detailed instruction from the tester, each individual took the test only once. All tests were performed at the team's training center computer room.

Data analysis

Data analysis was done with SPSS statistics software® through multivariate analysis of variance (MANOVA). Further, the Tukey post-hoc test was performed to identify statistical differences. The level of significance established was at $P < 0.05$.

RESULTS

No statistical significance was found between the age groups for eye alignment, depth perception, convergence, divergence, visual recognition, and VEPT scores (Table 1). Conversely, statistical significance was found for visual tracking, in which the Pro (93.4 ± 2.2 %, P = 0.05) and U20 (95.2 ± 1.8 %, P = 0.00) were significantly better than the U15 (85.9 ± 1.8 %). In addition, the U20 (95.2 ± 1.8 %, P = 0.03) was also significantly better than the U17 (87.2 ± 2.1 %). With regards to players of different positions (goalkeepers, defenders, midfielders and forwards), no statistical significance was found for any of the variables tested (Table 2).

Table 1. Age groups and visual skill scores

Age Group	*N*	VT (%)	*SD (±)*	VR (s)	*SD (±)*	DP (0-4)	*SD (±)*	D (%)	*SD (±)*	C (%)	*SD (±)*	VEPT (%)	*SD (±)*
Pro	10	93.4*	4.4	1.52	0.7	1.7	0.9	86.1	11.4	84.9	17.9	68.1	8.6
U20	15	95.2**	5.2	1.56	0.4	1.4	0.9	89.8	5.5	92.3	6.7	69.8	4.8
U17	11	87.2	5.9	1.21	0.2	1.6	1.2	87.3	5.8	88.9	13.9	72.1	6.1
U15	14	85.9	10.1	1.65	0.5	1.1	0.8	82.7	22.8	83.5	20.1	65.6	8.6

*Notes: VT – Visual Tracking, VR – Visual Recognition, DP – Depth Perception, D – Divergence, C – Convergence, VEPT – General Visual Skill Score. Statistical significance found only for Visual Tracking. * The Pro group was significantly better than the U15 (P = 0.05). **U20 was significantly greater than the U17 (P = 0.03) and U15 (P = 0.00).*

Table 2. Positions and visual skill scores

Position	*N*	VT (%)	*SD (±)*	VR (s)	*SD (±)*	DP (0-4)	*SD (±)*	D (%)	*SD (±)*	C (%)	*SD (±)*	VEPT (%)	*SD (±)*
Forwards	14	88.6	6.9	1.74	0.6	1.4	1.1	79.6	23.6	83.5	20.8	66.3	9.7
Midfielders	17	93.1	6.8	1.37	0.3	1.3	0.8	89.2	5.3	90.1	11.5	69.9	6.5
Defenders	15	88.8	9.8	1.55	0.5	1.4	1.1	90.1	4.7	90.9	7.5	70.1	6.1
Goalkeepers	4	92.5	5.7	1.04	0.1	1.5	0.5	86.2	4.7	78.5	25.8	68.3	4.4

Notes: VT – Visual Tracking, VR – Visual Recognition, DP – Depth Perception, D – Divergence, C – Convergence, VEPT – General Visual Skill Score. Statistical significance was not found.

DISCUSSION

Although some research studies show no benefits in sport performance from enhanced visual skills [33-34], the vast majority of studies reported that developed visual skills (or sports vision) would play a positive role in sports performance [4-8].Authors have reported that improvements in the athlete's visual skills can lead to quicker decision-making and faster motor response [35]. Thus, an advanced visual skills set is likely to have a positive effect on athletes' performance in many different sports. A study with rugby players showed an improvement in successful catches by the use of a visual skills training protocol prior to a game [8]. In a study with NCAA Division I college baseball players, significant differences in performance between athletes with visual skills training and without visual skills training was discovered. The players with visual skills training produced significantly higher batted-ball velocities than the players without visual skills training [12]. Likewise, in a study with table tennis players, significant enhancement in performance was reported after eight weeks of visual skills training [36]. In addition, a study with volleyball players indicated faster signal transmission in visual pathways in athletes with higher visual skills [7]. Similar results were found with tennis players. Overney, et al. (2008), reported a positive relationship between tennis performance and enhanced temporal processing [37]. Therefore several authors even suggested that sports coaches should insert visual skills into their training programs to enhance athletic performance [6, 8, 36].

A large number of research studies in visual skills were focused on the comparison between athletes and non-athletes. Most of these studies reported that athletes possess better visual skills than non-athletes [4, 9-11, 38-40]. In a study comparing visual performances of athletes and non-athletes using a clinical battery of vision tests, significantly better visual performances were found in the athletes for vergence facility, saccades, visual reaction time, peripheral awareness, and near point of convergence [9]. Quevedo-Junyent, et al., (2011) reported that athletes have a significantly higher dynamic visual acuity than non-athletes [40].

An enhanced visual skills set is not a privilege only for professional athletes. Student athletes have been found to possess an enhanced visual skills set as well. A study with college students also found a significantly higher dynamic visual acuity for the student athletes when compared to non-athlete students [39]. Another study with college students reported that college baseball players possess a significantly higher visual search capacity than non-athlete students [41].

Besides the comparison of athletes and non-athletes, there are also studies that suggest that athletes of different levels differ on visual skills capacities as well [10, 42-43]. In a study with golfers it was found that high-level players possessed significantly better visual skills than lower level players [43]. Jafarzadehpur et al., (2007) compared visual skills of volleyball players of different levels [10]. The study found that as the playing level increased, the visual skills capacities increased as well. In the present study, visual tracking was the only variable in which statistical significance was found. Professional players (players from the main squad) had significantly greater visual tracking than the players from the U15 squad. In addition, players from the U20 team had significantly better visual tracking scores than the U15 and U17 players. These results suggest that older and more experienced players possess greater visual tracking, which may be beneficial for their performance. These findings support similar results found by Allen, et al. (2004) [44]. In their study, visual tracking of expert athletes was superior to novice athletes. With regards to visual tracking, there are four major theories that try to explain the mechanisms of visual tracking. Posner (1980) recognized that visual tracking is carried out by shifting a "spotlight" of attention continuously from one target to the next [45]. Pylyshyn and Storm (1988) assumed that tracking is carried out pre-attentively without the help of memory representations [46]. On the other hand, Yantis (1992) and Kahneman, Treisman and Gibbs (1992)believed in high-level attentive processes, representations of objects, and spatial relations between the tracked objects [47-48]. In most recent studies, several authors agree that visual tracking is highly associated with visual memory, which relies critically on attention [47, 49-50]. Thus, more experienced players

would have an advantage by possessing a much larger motor memory when compared to younger athletes. With a greater array of movement representations available, situation-specific reference structures for anticipatory control would allow experienced athletes to have a better visual tracking performance when compared to less experienced players [51].In addition to the long-term memory, short-term memory also plays a critical role in visual tracking. According to Yantis (1992), subjects do not distinctly track the individual elements; instead, they can effectively track numerousindividually moving elements. The target elements are maintained in short-term memory and are rapidly updated as the elements move about the display [47].Furthermore, visual tracking performance is essentially based on temporary spatial memory and attention switching [50].

The results of the present study also support the findings of two similar studies that compared visual search of experienced versus inexperienced football players. Both of these studies found a significantly higher visual search capacity of the experienced group [31-32]. Findings from Du Toit, et al. (2009), also corroborates with the results of the present study. In their study, visual skills of football players were evaluated and showed that the higher the age group/level, the better the visual skills were [24]. The same study also compared visual skills of players of different positions, however no significant difference was found. Likewise, no statistical difference was found in the present study for visual skills of players of different positions.

However, despite all the positive results found on visual skills of the research studies mentioned above, it is yet to be known if enhancing visual skills of football players will result in increased football performance. A study with elite Canadian football players concluded that improving players' eye-foot coordination and other eye-linked motor skills, failed to reflect an increase in football performance [30]. Moreover, several limitations of the present study should be considered. The first limitation of the study wasthe difficulty to find related literature. Very few studies were done in visual skills of football players and none of them used the instrument of the present study (Vizual Edge). Thus, most of the literature reviewed is indirectly related, which makes the discussion of the results a difficult task. Another limitation of the present study was the fact that players from only one team were tested. To make better inferences about the population (elite football players) it would be necessary to have samplesfrom different teams and countries. Future studies with different teams in different countries are strongly suggested.Finally, the greatest limitation of the present study was related to the instrument. Vizual Edge is a computer-based visual skills software and some subjects presented a more developed ability to use the keyboard than others. Therefore, the results could have been influenced by how familiar a subject was with computers and keyboards.

CONCLUSION

In conclusion, the present study reports that the visual skills of more developed and experienced elite football players (U20 and main squad) are greater than the visual skills of younger and less experienced elite football players (U15 and U17). More specifically, visual tracking was the visual skill in which statistical significance was found. Therefore, experienced players may benefit from possessing more advanced visual tracking skills. However, more research is necessary to understand if these differences would actually result in a better performance in the game offootball. Also, these results suggest that visual tracking improves significantly in young elite football players throughout their football career (from U15 to U20). Considering that these athletes never received specific visual tracking training implies that elite football training in itself might be responsible for the development of visual tracking skill. In addition, the present study also indicates that there are no differences in visual skills between players of different positions. Finally, more research studies in this field are strongly recommended to better understand the visual skills of elite football players and its implications in football performance.

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