COLLEGE STUDENTS AND ATHLETES: DO VISUAL ABILITIES MEET DEMANDS?

by

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ABSTRACT

In this study, we are evaluating vision screening exams to determine if the subject's visual abilities meet their visual demands. The subjects we are using in this study are college students and college athletes who came to the vision screenings provided by the Michigan College of Optometry. The college students came voluntarily to the vision screenings offered at their residence halls. The athletes were required to attend the vision screenings. At the vision screenings, the students and athletes had a basic screening of their visual acuity, binocular vision, and ocular health. After reviewing the screening exam forms, we are comparing the results to the demands of the different sports that the athletes play and the demands of a college student to see if their visual abilities meet their visual demands. If the visual abilities do not meet the demands, the student's academic or athletic performance could be suffering. This study found the highest percentage of failed vision screenings in Men's Tennis (33.33 %) and Men's Track and Cross Country (33.33%), and the lowest percentage in Women's Track and Cross Country (0%), Cheerleading (0%), and Women's Tennis (0%). In the residence halls, 29.30% of students failed the vision screening. Improvement in an athletes' or student's visual system could improve both their scholastic performance and the performance in their chosen sport. The results of this study could prove valuable to both college coaches and administrators.

TABLE OF CONTENTS

Page

LIST OF TABLES

Introduction

Vision can play a crucial role in athletics and education. Quality vision can be the difference between making the winning basket and losing the game. It can be the difference between hitting a ball and being hit by one. Visual skills such as visual acuity and depth perception play an important role in many sports as players must locate and hit a target.[1,2] One of the most important visual skills in sports, visual acuity, can be improved by simply correcting refractive error.[1] In class, quality vision can be the difference between not being able to see the teacher's notes and examples, and copying accurate facts and figures. A student may have accurate visual acuity, but still have eye strain and discomfort if they have poor binocular vision skills.[3]

Dr. Jim Carlson relates visual skills to a pyramid. Ocular health makes up the base and foundation of the visual system.[4] The middle layer is ocular function, including depth perception, extraocular muscle movements, and fixation.[4] The top of the pyramid is the brain, which helps the other layers to function and work together.[4] Athletes and students both need a well-balanced visual pyramid to perform and achieve their best. Both school and sports are competitive arenas in which quality vision can give the student and competitor an edge.

In this study, we are examining whether Ferris State University's students and athletes have the visual abilities to meet the visual demands of their sport or coursework. Visual abilities refer to an individual student's or athlete's visual acuity, binocular vision, and ocular health. Visual demands refer to the visual acuity, binocular vision, and ocular health needed for a given sport or classroom

setting. In this study, the areas of visual acuity, binocular vision, and ocular health were tested and analyzed.

Methods

In this screening both athletes and students were screened. This screening was mandatory for many of the athletes from different Ferris State University sports teams. The student vision screening was optional and was set up and advertised in residence halls. Students were able to come and be screened for free during a certain time period.

In the vision screening a pass fail criterion was used for the areas of visual acuity, binocular vision or alignment, and ocular health. The pass fail criterion was based on what is considered outside of normal limits in a comprehensive vision exam. Failing this criterion would indicate that additional treatment was necessary. In the area of visual acuity, the student or athlete must achieve a distance acuity of 20/30 or better OD and OS. On refraction, they needed to have between -0.50D to +1.25D of spherical correction and less than 1.00D of cylinder OD and OS, and less than 1.00D of anisometropia OU to pass. To pass the binocular vision or alignment area, the student or athlete needed less than 10 diopters of exophoria or less than 6 diopters of esophoria at near, achieved greater than 60 seconds of arc on stereovision testing, and be able to clear +/- 2.00 diopter flippers OU more than 6 times in 30 seconds. If they were unable to clear the +/-2.00 diopter flipper, the +/- 1.50 diopter flipper was used. Inability to clear the +/- 1.50 diopter flipper 6 times in 30 seconds was considered failing this area. To

pass the ocular health area, there could not be any signs of ocular disease or systemic disease that may cause ocular changes.

Results

Our vision screenings found a variety of pass and fail percentages across the athletic teams tested as shown in Table 1.

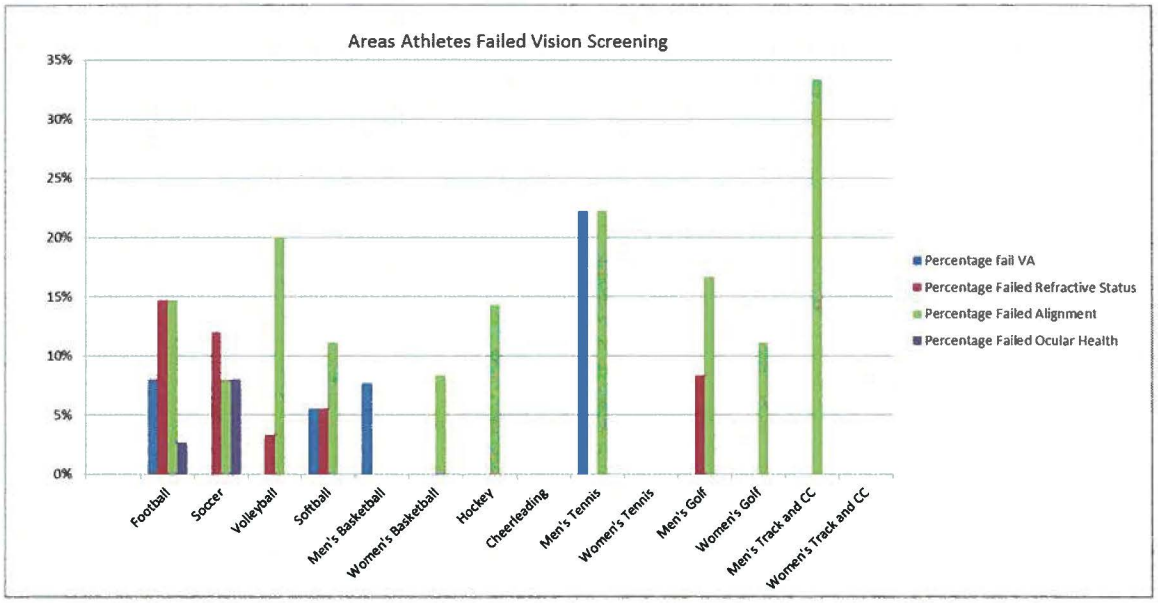

Table 1

In our vision screening, 18 softball players were tested and 2 players, or 11.11 %, of the team failed. One player or 5.56 % failed the visual acuity area and one player failed the refractive status area of the screening. In the binocular vision area of our screening 2 softball players, or 11.11 %, failed.

Football players had the highest number of players tested at 75 players of the 118 member team. They also had the highest number of players at 20 players, or 26.67%, of their team fail the vision screening compared to the other teams

tested. Six players or 8.00% of the team tested failed the visual acuity area. Eleven players or 14.67% failed the areas of refractive status and alignment. In the area of ocular health 2 players, or 2.67%, of those tested failed.

In our vision screenings, both the men's and women's basketball teams were tested. The men's basketball team had 13 players of the 15 member team tested. Of those tested 7.69 % failed the visual acuity area of the screening. The women's basketball team had 12 of the team's 15 players tested with an 8.33 % failure rate. All of these failed screenings were in the area of alignment. None of the men's basketball team failed the stereoacuity screening. However, the average stereoacuity of the men's team was 36.67 seconds of arc, which is worse than the women's team's average stereoacuity. On the women's basketball team there was an average stereoacuity of 35.83 seconds of arc, with one player having failed the screening with 70 seconds of arc.

In the sport of tennis, the women's team had a higher passing rate then the men's tennis team. The 8 players tested of the 9 player women's tennis team had a 100% pass rate. The men's team had 9 of the 10 member team screened. The men's tennis team had 33.33% or 3 of the 9 members of the team tested fail the screening. Two players, or 22.22%, failed the area of visual acuity and two players failed alignment

The soccer team had 25 of its 26 team members tested. Overall the soccer team had 7 players or 28% of the 25 team members tested fail the vision screening. Three players or 12% failed in the area of refractive status, 2 players

or 8.00% failed in the area of alignment, and 8.00% failed in the area of ocular health.

The women's volleyball team had 15 players of the 18 player team tested. Three players, or 20.00%, of the tested players fail the screening. There was a higher fail rate in the alignment testing, 20.00%, than the refractive status testing, 3.33%.

The freshman on the men's hockey team had 7 players tested. Only one player or 14.29% failed the area of alignment.

In our screening of the cheerleading team, there was a 100% pass rate in all areas. Sixteen team members were tested of the 24 member team.

The men's golf team had 12 of the 14 player team tested and 8.33%, or 2 players, of the screened players fail the refractive status portion of the screening. The women's golf team of 11 players had 9 players tested and 1 player fail the screening. The men and women's golf team had 16.67% and 11.11% of the screened members respectively fail the alignment area of the screening. The average stereoacuity of the men's golf team was 41.25 seconds of arc, while the women's team averaged 35.55 seconds of arc.

In the women's track and cross country team, there was a 100% pass rate of the 2 team members tested on the 31 member team. The men's track team had 6 members of the 46 member team tested. In the men's track and cross country team did not do as well as the women's team with 33.33%, or 2 players, of the 6 players tested failed the alignment screening.

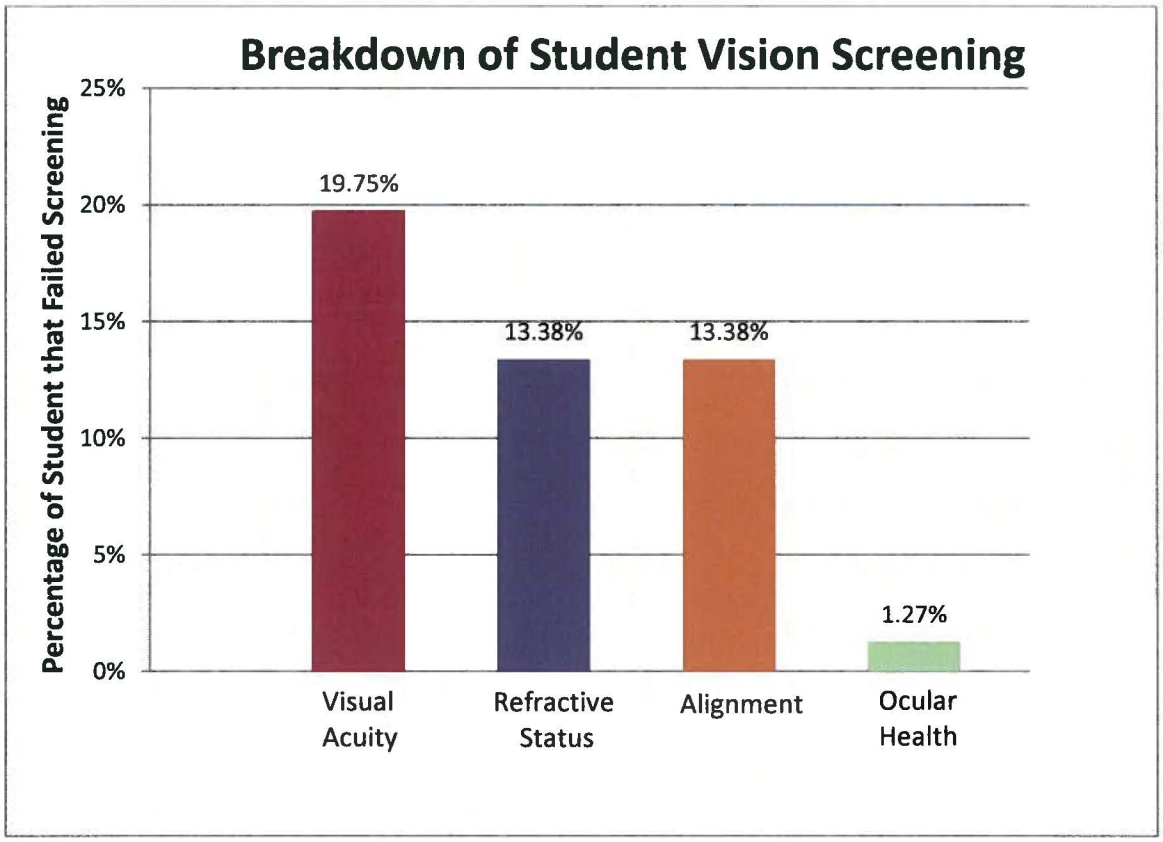

Table 2

In the student vision screening 157 students were tested and 29.30%, or 46 students, failed the screening. A breakdown of the percentages and areas that the screened students failed is given in Table 2. The area of visual acuity had the highest fail rate at 19.75%. The next most common areas failed in the screening were the areas of refractive error and alignment, with 13.8% of students failing each.

Discussion

One study found that nearly 80 % of Major League Baseball players had a visual acuity of 20/15 or better and only 1.3 % had a visual acuity of 20/30 or worse.[1] In our screening 1 softball player, or 5.56% of players tested had a visual

acuity of 20/30 or worse. Another study found that Olympic Softball players had an average contour stereoacuity of 32.12 seconds of arc.[2] This means that the softball team may have 11.11 % of their players with less than 60 seconds of arc, much less than the Olympic average of 32.23 seconds of arc. Having good visual acuity and depth perception is very important in a sport that requires an accuracy of +/- 2 to 5 milliseconds to decide when to hit or catch a ball.[5] If the speed of the incoming ball is misjudged by 1mph the bat position could be as far as 4 inches off from the intended target, if misjudged by 5 mph the bat position could be off by as much as 2 feet.[4] When this much accuracy is needed, correcting even small refractive errors can be beneficial.

The football team had the highest number and one of the highest percentages of team members tested fail. This could be in part to the fact that there is a variety of visual skill levels needed for the different positions in this sport. For example, an offensive lineman does not need have the precision acuity that a quarterback does because his targets are larger and often positioned close to him. On the other hand, both visual acuity and stereoacuity play an important role for a quarterback who must search for an open teammate down field and judge how far he must throw the ball. Thus, some positions on the football team could play college level football without noticing possible refractive error or binocular vision problems while other positions could not. However, in this study, we did not break down athletes into positions that they play, so there is a possibility that there are players that may need a higher level of acuity and binocularity to improve and do not have it. This means that there are areas in the football team's

vision that could use correction and improvement which could translate in to more wins on the field.

In basketball, there is a large ball with a relatively large target, but acuity and depth perception still play an important role. A study by Applegate and Applegate found that when visual acuity was blurred to 20/40 the free-throw shooting percentage decreased, although not statistically significant, by 10%.[6] This may not seem like a large percentage, however, when considering this decrease in the 7.69% of the men's basketball team tested over an entire season, it adds up to many lost points and perhaps lost games. Another study notes a positive correlation between making free-throw shots and depth perception.[7]As visual acuity is improved, there is also an improvement in depth perception.[7] In turn, correcting visual acuity could increase the number of free-throws made. Although only one player failed this area of the screening, an improvement in stereoacuity could be made on most of the players tested. Once again, by improving their stereoacuity, the players could increase the number of shots they make.[7]

In tennis visual acuity and depth perception are very important, so important that returning a serve was listed as number five in the top 10 hardest thing to do in sports because "You've got to see a 130 mph serve to return it."[8] In a study on visuo-motor delay there was found to be a difference in reaction time between expert and non-expert tennis players. The expert players reacted in 216 milliseconds compared to the non-experts 240 milliseconds. [5] By improving even small refractive errors and alignment, both the men's and women's tennis teams

could have a more efficient reaction time. Decreasing reaction time by even milliseconds may sound like a small amount, but over each of the hundreds of strokes over the course of a match may be the difference between winning and losing.

The Olympic soccer team had an average visual acuity of approximately 20/15, and an average stereoacuity of 33.64 seconds of arc.[2] The Ferris soccer team has uncorrected refractive error that could improve their acuity and bring them closer to the visual abilities of the Olympic athletes.

In a sport where you must be able to follow, hit, and dive, for a ball, depth perception and visual acuity are very important. The volleyball team could benefit from refractive correction and improvement of their binocular vision status, especially when compared to the Olympic averages. The Olympic Volleyball team testing showed great visual skills with an average stereoacuity of 35.81 seconds of arc and average visual acuity of approximately 20/15.[5]

In hockey, players need excellent visual acuity to see such a small fast moving target. It is likely that by the time players have reached college level they have corrected their refractive error. Also, unlike the other sports at this screening which are Division 2 teams, the hockey team is Division 1. Playing at a Division 1 level requires a greater visual demand, so it makes sense that the players that have made it to this level have the required visual abilities.

Having a 100% pass rate in the sport of cheerleading is slightly surprising considering that there is not a ball or a target size that may make it harder to

compete in this sport at a college level. However, having good depth perception would be important when tossing or catching teammates.

In golf, hitting such a small ball and judge the distance it needs to travel both binocularity and visual acuity play an important role. Although the ball is not moving towards the player, as it is in many sports, being able to have an accurate view of the ball and the target is advantageous. This is especially true in putting. One study found an increase in putting accuracy when comparing putting monocularly versus putting with normal binocular vision by 14%, 8%, and 13% for putting at a distance of 3, 6, and 9 feet respectively.[9] Both the men's and women's golf teams could improve their stereoacuity. This improvement in stereo vision could, in turn, improve their putting ability, and change the course of a game, as putting can make up nearly 50 % of the golf game.[9]

In the sport of track and field, depth perception may not be as crucial as it is in other sports. The Olympic track and field team had an average stereoacuity of 47.00 seconds of arc, which is the worst average stereo acuity of all the Olympic teams' tested.[5] This may indicate that depending on the area of track and field you compete in, depth perception may not be as big of a factor even at the college level.

This screening was optional to the students, and most students that came likely had a symptom that brought them there. Blurred vision may be one of the first and most obvious symptoms a patient would notice, which makes it likely to have the highest fail rate. It is important to correct and optimize the vision in the

students as college involves many visual learning tools whether it is projected notes and figures at a distance, or near book and computer work. One study even found that passing a binocular screening is an indicator of success in the classroom.[10] Having uncorrected refractive error and alignment errors can cause strain on the visual system. In fact, most college students have visual discomfort, likely due to the increase in near work at college level of studying.[11] A study on visual discomfort in college students found that uncorrected refractive error and disorders of accommodation and vergence all play a role in symptoms and strain in the visual system. [12] Although different majors have different course loads, there still is likely to be an increase in near work required compared to high school level courses. Refractive errors and alignment errors causing visual discomfort make studying more difficult. By addressing these issues students could be more productive academically, and in turn more successful in their careers.

Conclusion

In conclusion, there is room for improvement in nearly every sport tested and within the student body. This study did not break sports teams down into what positions on a team failed each, which could have shown a better correlation between the visual demands of each position. However, it has been found that correcting even small refractive errors can improve a player's performance.[13] It is important for not only athletes but coaches and sports physicians to realize the difference visual correction can make, as there is a general lack of knowledge in this area.[13] It is equally important to inform the students of the symptoms of

visual strain, and educate them on how to improve it. Whether student or athlete, optimal visual correction is a tool needed for optimal performance.

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