

VISUAL SKILLS PREDICTION OF COLLEGE LEVEL ATHLETIC SUCCESS

by

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ABSTRACT

Background: The main objective of this study was to determine if specific visual attributes can be used to predict success in athletes at the collegiate level.

Methods: A total of 28 collegiate softball players' visual skills were assessed through testing binocular visual acuity at distance and near, dynamic visual acuity, distance and near phoric posture, and depth perception of the athletes.

The success of the athletes was then evaluated through analysis of a coach's survey that provided information about the athletes' skill levels and objective performance in specific areas. This information allowed for a comparison

between skill level and visual attributes. **Results:** Our results indicated that there were specific attributes that showed a statistically significant positive correlation which were leadership with depth perception, attitude with near visual acuity, athletic ability with distance phoria, and promise for the future with dynamic

visual low RPM accuracy. **Conclusion:** The data that was gleaned from this study provides information on how each visual attribute may affect various aspects of a sport, as well as information that can be used to care for patients who participate

in athletics and want to improve their athletic skills by participating in sports vision therapy. Sports vision research is an area that continues to grow and

thrive. This study provides optometrists additional information which can be used to hone in on the visual skills that are most beneficial for their sports vision patients.

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CHAPTER 1 BACKGROUND

The main objective of this study was to determine if specific visual attributes can be used to predict success in athletes at the collegiate level. A study performed by Poltavski and Biberdorf evaluated the role of visual discrimination of Division I collegiate hockey players and was one of the first studies to show that visual skills may be important to players actual performance during game situations. The study showed that 33% of variance in game points was significantly related to better visual discrimination of stimuli. Additionally, stereoptic quickness and reaction time to a visual stimulus played a significant role in the length of a player's penalty time.¹

Another study compared how training athletes using three types of vision therapy exercises effected visual skills of sports performance. The study focused on determining which exercises would be most beneficial to add to physical training regiments in order to improve athletic performance. The study evaluated the role of visual reaction time, peripheral vision, and depth perception which found that 90% of participants experienced improvement in the skill in which they were trained. The high level of improvement supported the efficacy of vision therapy as a valid choice for an exercise to improve the visual skills most used during sports.² In a basketball study by Kofsky and Starfield, five weeks of peripheral awareness, static and dynamic visual acuity, visual reaction time, visualization/visual imagery, and eye-hand coordination training was performed and improvements in both visual function and actual game performance were reported.³

Our study assessed a variety of visual attributes, as well as athletic success in order to determine which skills correlated strongest with actual performance skills. The attributes that were measured were binocular visual acuity at distance and near, dynamic visual acuity, distance and near phoric posture, and depth perception. Athletic success was evaluated with a coach's survey that provided information about the athletes' skill levels and objective performance in specific areas. This information allowed for a comparison between skill level and visual attributes.

CHAPTER 2 METHODS

Our study was performed on 28 collegiate softball players' whose visual skills were assessed through testing binocular visual acuity at distance and near, dynamic visual acuity, distance and near phoric posture, and depth perception of the athletes. The research methods that were used were approved by the IRB prior to testing. For all testing, players who habitually wore glasses or contact lenses during the sport were instructed to wear their correction for the assessment. Binocular visual acuity measures were obtained at near and distance using a Snellen visual acuity chart. The values were then converted into LogMAR units for data analysis. Binocular dynamic visual acuity was measured using the Bernell Rotation Trainer first on low RPM and then on high RPM. This device serves to assess the ability to differentiate fine details of a moving object, which can relate to sports as the ability to differentiate the seams on a pitched baseball at a batter or the rotation of a batted ball rolling at a fielder.⁴ An early

study indicated significant differences in dynamic stereopsis between baseball players and untrained subjects.⁵

The time it took the athletes to read off every letter was then recorded as their time for that section and the amount they accurately stated out of the 57 characters was recorded as their accuracy. The near and distance phoric posture of the players' was assessed with an objective cover test at 40 cm and six meters. The final assessment evaluated depth perception at near using a Randot Stereo Test Book. Each visual attribute was assessed during a practice at the beginning of the collegiate season. At the end of the season, a coach's survey was given which evaluated six different aspects of athletic success. Players were given a score from one to five based in each category: performance, attitude, leadership, promise for future, dedication, and athletic ability. An overall score was calculated by averaging the scores from each category.

CHAPTER 3 RESULTS

Of the athletes involved, 64% did not wear any type of optical correction and the remaining 36% wore contact lenses. Depth perception was assessed with a Randot Stereo Test Book and showed that 57% of the athletes had 20 seconds of depth perception. In total, 82% of the players' had distance visual acuities better than 20/20. A Mann-Whitney U test for the coach's survey resulted in no statistically significant difference between wearing or not wearing correction and the coach's survey results.

The 28 players' visual attributes were evaluated and the data was analyzed for significant correlations to the coach's survey categories with a Spearman's Rho Correlations Coefficient. The data revealed that the overall score is statistically correlated to the variables which make up the Overall Score. However, none of the visual skills are correlated to the Overall Score. For individual categories on the coach's survey, the results showed Attitude had a positive correlation to Near Visual Acuity ($p=0.049$), Leadership had a positive correlation to Depth Perception ($p=0.046$), Promise for the Future had a positive correlation to Dynamic Visual Acuity with low RPM ($p=0.029$), and Athletic Ability had a positive correlation to Distance Phoria ($p=0.040$).

Table 1 Spearman Rho Correlations

Coach's Survey	Distance Visual Acuity	Near Visual Acuity	Depth Perception (Sec of Arc)	Near Phoria	Distance Phoria	Dynamic VA High RPM Accuracy	Dynamic VA High RPM Time	Dynamic VA Low RPM Accuracy	Dynamic VA Low RPM Time
Performance	0.682	0.675	0.173	0.205	0.519	0.377	0.670	0.067	0.602
Attitude	0.827	0.049	0.258	0.689	0.0175	0.766	0.105	0.528	0.372
Leadership	0.237	0.141	0.046	0.214	0.596	0.729	0.802	0.837	0.355
Promise for Future	0.374	0.395	0.356	0.481	0.896	0.318	0.992	0.029	0.796
Dedication	0.662	0.120	0.459	0.819	0.794	0.325	0.326	0.852	0.180
Athletic Ability	0.808	0.261	0.828	0.693	0.040	0.880	0.700	0.581	0.050
Overall Score	0.944	0.189	0.217	0.640	0.711	0.470	0.557	0.350	0.154

A Kruskal-Wallis analysis was done to determine statistically significant differences between the Coach's survey and the visual skills. There was no statistically significant difference in the Coach's rankings for Performance, Attitude, Dedication, or Athletic Ability with any of the visual skills. There was a statistically significant difference between the Promise for the Future ranking and dynamic visual acuity accuracy with low RPM ($H=7.982$, $N=28$, $p=0.046$, two-tailed).

The players' near phorias were grouped into those within Morgan's Norms and those outside of Morgan's norms. Phoria measurements were then compared to the six categories of the Coach's survey. There was no statistically significant difference between being inside or outside of Morgan's Norms for Attitude, Leadership, Dedication, and Athletic Ability. There was a statically significant difference between being inside or outside of Morgan's Norms for Performance ($U=21.00$, $N1=22$, $N2= 6$, $p=0.007$, two-tailed). A statistically significant difference was also found between being inside or outside of Morgan's Norms for Promise for Future ($U=12.50$, $N1= 22$, $N2= 6$, $p=0.001$, two-tailed). When comparing being inside or outside of Morgan's Norms to Overall score there was a statistically significant difference ($U=23.0$, $N1=22$, $N2=6$, $p=0.015$, two-tailed). In each category: Performance, Promise for the Future, and Overall score the Mean Rank was higher for the group inside of Morgan's Norms; players inside of Morgan's norms had higher scores in these three areas compared to those outside Morgan's Norms.

When evaluating distance phoria, inside and outside of Morgan's Norms, to the six categories of the coach's survey, there was no statistically significant difference between the phoria being inside or outside of Morgan's Norms for Performance, Attitude, Leadership, Dedication, Promise for the Future, and Overall Score. There was a statistically significant difference with a medium effect size between being inside and outside of Morgan's Norms for distance phoria for Athletic Ability ($U=22$, $N1= 23$, $N2= 5$, $p=0.026$, two-tailed). Those outside of Morgan's Norms had a higher Mean Rank than those inside norms; those with distance phoria's outside of Morgan's Norms were ranked higher for their Athletic Ability than those inside Morgan's Norms.

CHAPTER 4 CONCLUSION

The data that was gleaned from this study provides information on how each visual attribute may affect specific aspects of a sport. It also provides information that can be used to care for athletes who want to improve their athletic skills by participating in sports vision therapy. The specific attributes that showed a statistically significant positive correlation were leadership with depth perception, attitude with near visual acuity, athletic ability with distance phoria, and promise for the future with dynamic visual low RPM accuracy. Based on our findings, players who want to improve in certain aspects of a sport could participate in vision therapy centered around the specific visual attribute that correlates to what they want to improve. For example, that a player whose goal is to improve their promise for the future could consider vision therapy activities that

focus on dynamic visual low RPM accuracy. Similarly, a patient who hopes to improve their athletic ability could focus on activities to improve their distance phoria. Several other studies of athletes' vision demonstrated superior stereopsis performance in sports that require rapid and accurate visuomotor function as compared to non-athletes. One of the study's results confirmed that professional baseball players had significantly better distance and near stereo acuity than those of the general population.^{6,7} Another study compared one-handed catching performance between catchers with high and low binocular depth vision or stereopsis. Tennis balls were projected at various velocities towards each participant, and results showed that the participants with better stereopsis were more successful at catching the balls compared to those with poor binocular visual function. It also showed that participants with low stereopsis made more temporal errors.⁸

In conclusion, vision therapy optometrists working with athletes can build plans with activities centered around specific visual skills such as dynamic visual acuity, distance phoria, and depth perception. Our results are fascinating because many people do not correlate performance skills with specific visual attributes; however, we have shown several key correlations between performance indicators and depth perception, visual acuity, distance phoric posture, and dynamic visual low RPM accuracy. Sports vision research is an area that continues to grow and thrive. This study provides optometrists additional information needed to hone in on visual skills that are most beneficial for their sports vision patients.

REFERENCES:

1. Poltavski, D., & Biberdorf, D. (2014). The role of visual perception measures used in sports vision programs in predicting actual game performance in Division I collegiate hockey players. *Journal of Sports Sciences*, 33(6), 597-608.
2. Thomas, C., Andrich, P., & Motz, V. A. (2017). Comparison of three types of vision therapy exercises on visual skills of sports performance. *Optometry and Visual Performance*, 5(1), 21st ser., 183-221.
3. Kofsky, M., & Starfield, B. (1989). SPORTS vision training and experimental program with Australian institute of sport basketball players. *Australian Journal of Optometry*, 6, 15-17.
4. Miskewicz-Zastrow, A., Bishop, E., Zastrow, A., D. M., Cuevas, & Rainey, B. B. (April 2015). A Standardized Procedure and Normative Values for Measuring Binocular Dynamic Visual Acuity. *Optometry & Visual Performance*, 3(2). Retrieved from <https://www.ovpjournal.org/uploads/2/3/8/9/23898265/3-2-8.pdf>.
5. Solomon, H., Zinn, W. J., & Vacroux, A. (July 1998). Dynamic stereoacuity: A test for hitting a baseball? *Journal of the American Optometric Association*, 7(522).
6. Boden, L. M., Rosengren, K. J., Martin, D. F., & Boden, S. D. (2009). A comparison of static near stereo acuity in youth baseball/softball players and non-ball players. *Optometry - Journal of the American Optometric Association*, 80(3), 121-125. doi:10.1016/j.optm.2008.06.009
7. Laby, D. M., Kirschen, D. G., & Pantall, P. (2011). The Visual Function of Olympic-Level Athletes—An Initial Report. *Eye & Contact Lens: Science & Clinical Practice*, 37(3), 116-122. doi:10.1097/icl.0b013e31820c5002
8. Lenoir, M. (1999). Ecological Relevance Of Stereopsis In One-Handed Ball-Catching. *Perceptual and Motor Skills*, 89(6), 495. doi:10.2466/pms.89.6.495-508

APPENDIX A

FERRIS STATE UNIVERSITY

Institutional Review Board for Human Subjects in Research

Research & Sponsored Programs, 1010 Campus Drive, FLITE 410G · Big Rapids, MI 49307

Date: October 4, 2017

To: Dr. Alison Jenerou

From: Dr. Gregory Wellman, IRB Chair

Re: IRB Application #160310 (*Visual Skills Prediction of College Level Athletic Success*)

The Ferris State University Institutional Review Board (IRB) has reviewed and approved your request for revisions to add investigator Andrew Bringard to the study, "*Visual Skills Prediction of College Level Athletic Success*" (#160310). This approval follows the expiration date of your initial application approval. **As such, you may collect data according to the procedures outlined until April 18, 2018.**

Your project will continue to be subject to the research protocols as mandated by Title 45 Code of Federal Regulations, Part 46 (45 CFR 46) for using human subjects in research. It is your obligation to inform the IRB of any changes in your research protocol that would substantially alter the methods and procedures reviewed and approved by the IRB in your application. Thank you for your compliance with these guidelines and best wishes for a successful research endeavor. Please let us know if the IRB can be of any future assistance.

Regards,

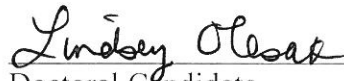


Ferris State University Institutional Review Board
Office of Research and Sponsored Programs


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Library Approval and Release

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We, Lindsey Olesak and Andrew Bringard, hereby release this paper as described above to Ferris State University with the understanding that it will be accessible to the general public. This release is required under the provisions of the Federal Privacy Act.



Doctoral Candidate



Doctoral Candidate

04/27/18

Date