EYE DOMINANCE AND BASEBALL BATTING

Protocol for Pilot Project

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ABSTRACT

Two Ferris State College varsity baseball players were utilized in this pilot project to determine if eye dominance and binocularity affect visual performance in hitting a baseball. The results indicate from these two players that eye dominance does not play a significant role in performance, however, binocularity is a very integral part in performance. It can be concluded that the experiment needs to be ran with more subjects to substantiate the data found in this pilot project.

KEY WORDS

Eye dominance, binocularity, dominant eye, nondominant eye, ocular batting conditions, visual requirements, pilot project.
INTRODUCTION

There has been extensive research done in the field of Sports Vision, a relatively new and interesting field of optometry. One of the most perplexing athletic activities involves the visual skills and requirements of a baseball player hitting a pitched baseball. There has been a lot of work done in this area, and yet we still don't fully understand the visual tasks required that allows a batter to hit a baseball at speeds approaching 90 m.p.h.

We have learned that the often-heard coaching instructions for batters such as "keep your eye on the ball" and "watch the ball until it hits the bat" are physiologically impossible. The human pursuit movement mechanism can not achieve the angular velocity required to follow a pitch from the moment it leaves the pitcher's hand until it reaches the batter. By using eye tracking devices it was determined that batters use a "pursuit-saccade" motion as opposed to a "pursuit-only" eye movement. We have also learned that by cyclopledging batters and measuring their visual performance cyclopledged and noncyclopledged, accommodation does not play a significant role in the performance of a batter.

These are just a few of the experiments that have been run in order to gain more information on the visual requirements needed to hit a baseball going at high speeds. This is a pilot project in order to determine if eye dominance in batting affects visual performance, along with binocularity affecting visual performance.
METHOD

Two Ferris State College varsity baseball players were recruited to serve as subjects for this experiment. Eye dominance was determined using the "hole in the hand" method. Stereo acuity was determined by using the Wirt Rings and visual acuity was taken at an earlier time. A pitching machine was placed upon a regulation mound and calibrated to deliver a pitch to home plate at a speed of 77 m.p.h. The pitching machine was 60.5 feet from home plate, however, the pitching machine released the ball 3.5 feet in front of the rubber to compensate for the stride that the pitcher would normally take in a wind-up situation.

There were three different ocular batting conditions created: A) player batting binocular. B) player batting with dominant eye occluded. C) player batting with nondominant eye occluded. The experiment was designed to be run with six subjects. Each ocular condition was to be run in a different order for each batter so not to create any bias in the way the conditions were presented to each batter. See Figure 1. Because there were only two batters, it was decided that condition "A" would be binocular, condition "B" would be nondominant eye occluded, and condition "C" would be dominant eye occluded; and it would be run in this order.

Figure 1. 6 Batters 3 Ocular Batting Conditions
1. A-B-C  A. Binocular
2. A-C-B  B. Nondominant eye occluded
3. B-A-C  C. Dominant eye occluded
4. B-C-A
5. C-A-B
6. C-B-A
Each batter was given seven practice pitches for each condition. After the practice pitches the batter was given 20 swings for each condition. He was told that he could swing at the pitches he thought were good, and not swing at the pitches he thought were bad. Their performance in each condition was scored based on a numerical value between 0-4, according to the direction the ball was hit. See figure 2. If the batter swung and he missed the ball completely, he was given a score of 0. If the batter made contact with the ball, but it went backward within a 45 degree area of the horizontal into zone D or E, he was given a score of 1. If the batter made contact with the ball, but it went backwards more vertically than horizontally into zone C or F, he was given a score of 2. If the batter made contact with the ball, but it went forward more vertically than horizontally into zone B or G, he was given a score of 3. If the batter made contact with the ball and it went forward, horizontally more than vertically within 45 degrees into zone A or H, he was given a score of 4.

When the experiment was completed, the average score for each subject in each condition was determined and then the average score for both subjects in each condition was determined.

RESULTS

Both batters demonstrated left eye dominance and both baseball players batted right handed. Batter "A's" distant visual acuities demonstrated to
be 20/20 in each eye and he had a stereo acuity of 50 seconds of arc. Batting binocularly he achieved a total score of 68 for the 20 swings. This averages out to be 3.4 per swing. With his right eye occluded (nondominant eye), he achieved a score of 57 for the 20 swings, which averages out to be 2.85 per swing; a significant decrease from the binocular condition. With his left eye occluded (dominant eye), he achieved a score of 58 for an average of 2.9 per swing. Again this is a considerable decrease from the binocular condition, however, very consistent with the condition of the right eye occluded.

Batter "B's" visual acuities were recorded to be 20/15 in each eye, and his stereo acuity was 40 seconds of arc. Batting binocularly he achieved a score of 54 for his 20 swings. This averages out to be 2.7 per swing. Batting with his right eye occluded (nondominant eye), he achieved a score of 39 which averaged out to be 1.95 per swing. Again, this shows a decrease in performance from that of the binocular condition. With the left eye occluded (dominant eye), the batter achieved a score of 47 for an average of 2.35 per swing. This is down from the binocular condition, however, there is a considerable improvement from when the right eye was occluded (nondominant eye). See figure 3.

<table>
<thead>
<tr>
<th>Figure 3</th>
<th>TRIAL 2</th>
<th>Condition</th>
<th>Binocular</th>
<th>Rt eye occluded</th>
<th>Lt eye occluded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Player A</td>
<td>3.4</td>
<td>2.85</td>
<td>2.9</td>
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<tr>
<td>Player B</td>
<td>2.7</td>
<td>1.95</td>
<td>2.35</td>
<td></td>
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</tr>
<tr>
<td>AVERAGE</td>
<td>3.05</td>
<td>2.4</td>
<td>2.63</td>
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The results indicate that binocularity plays a significant role in visual performance. This data shows that eye dominance does not play a significant role in batting performance of baseball players. It is obvious that more subjects are needed in this experiment to conclusively make this statement, however, the data was consistent for each player. There
was a definite decrease in performance when either eye was occluded, and in fact, the data supports that performance was better when the dominant eye was occluded.

The data also indicates that performance was worse when the eye closest to the pitcher was occluded, dominant eye in both cases. It should be noted that subjectively the batters thought just the opposite. They felt it was more difficult to hit the ball when the eye closest to the pitcher was patched. Again, more subjects are needed to verify this finding.

DISCUSSION

It was noted by all the batters the great difficulty to hit the ball with either eye occluded. The localization of the ball was very hard to judge. It was difficult to determine if a ball was outside the plate or inside the plate. Speed was also hard to judge. As stated earlier, the batters felt that it was more difficult to hit the pitches when the eye closest to the pitcher was occluded.

The way we scored seemed very good and fair on paper, however, it now appears that the scoring may have been slightly favoring the hitters. There were too many balls that were hit forward or backward within the 45 degree range of the horizontal that were given scores of 4 or 2 which may not have been good hits. Perhaps if we could have narrowed the zones down to 30 degrees off the horizontal the data may have showed other findings. This would have allowed a more subjective variability, however. A more objective method of scoring may be needed.

And of course, more subjects would have made the experiment more conclusive, and possibly helped us to find out some other important information.
CONCLUSION

The data gained from this pilot project indicate that the experiment needs to be run with more subjects. Some important knowledge can be gained in helping us better understand the visual requirements needed for a batter to hit a baseball going at high speeds. Although data in this experiment suggest that eye dominance does not play a significant role in visual performance, more subjects are needed to further substantiate this. The data does tell us that binocularity plays an integral part of visual performance in hitting a baseball. This data also indicates that when the eye closest to the pitcher is occluded performance was better than if the eye furthest from the pitcher is occluded. Again, more subjects are needed accurately conclude this.

With more subjects in the experiment, other correlations between right handed batters and left handed batters, and eye dominance can be made. Does eye dominance favor a particular hand of batting or is there no correlation at all? Does having the eye closest to the pitcher occluded have any relationship to performance if this eye is the dominant eye or the non-dominant eye? These questions and more can be answered by repeating the experiment with more subjects.

In addition to repeating this experiment, further research in necessary to fully understand the complex visual tasks involved in hitting a baseball.

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FOOTNOTES:


2. "Role of Accommodation in Hitting Baseballs", Rance Hafner, O.D.
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