# Use of the EYEPORT™ Vision Training System to Enhance the Visual Performance of Little League Baseball Players

■ **Teresa Bowen, M.S.**[a]
■ **Lisa Horth, Ph.D.**[b]

a. 2708 Rockwell Drive, Davis, California 95616
b. Department of Biology, Old Dominion University, Norfolk, VA 23529

## Abstract

*This study examines whether use of the EYEPORT[TM] vision training system can improve the hitting performance of a sample of little league baseball players. Twelve little league baseball players each used the system for three consecutive weeks, six days per week, 10 minutes per day. Before and after the EYEPORT™ training sessions, each player was given a series of 40 curve ball pitches fed from an automatic pitching machine, at 50 mph. The mean number of successful curve balls hit, before and after using the system, was compared using a paired-sample T-test. Significant improvement in the total number of hits was demonstrated. The mean number of hits before and after EYEPORT™ use was 17 and 28, respectively and the average improvement in number of hits was 90%. Hits plus fouls were also evaluated in a similar fashion. Here, the mean number of hits before and after EYEPORT™ use was 24 and 32, respectively and the players showed a 34% improvement in hits plus fouls. Our results support the premise that the vision training system improved batting performance in our sample of Little League baseball players.*

## INTRODUCTION

Some experts in baseball and optometry are of the opinion that a variety of visual skills is particularly important in mastering the difficult skill of accurately hitting a baseball.[1,2]

Baseball is a globally popular sport. In 2003, there were more than 2.3 million children worldwide involved in Little League Baseball.[3] When Little League players begin pitching at age eight or nine, they are initially taught how to pitch a fastball – a ball with a trajectory that is primarily straight. To hit a fastball, the batter must first observe the ball as it is released from the pitcher's hand and then swing the bat at the ball as it crosses the plate. Because a fastball has relatively little sideways or vertical movement as it crosses the plate, hitting this pitch requires less precise tracking skills than hitting a pitch with greater movement over the plate, such as a curve ball.

Little League pitchers are not taught how to throw a curve ball until the age of 11 or 12. This is because throwing a curve ball is more difficult to master than throwing a fastball and can cause injury to the child's arm. Curve balls are thrown with topspin and/or sidespin, resulting in a ball that drops vertically, moves horizontally or a combination of the two, as it crosses the plate. While a fastball is primarily intended to pass the batter before he has time to swing, a curve ball breaks down, left or right just as it crosses the plate. This fools the batter into swinging at a ball that's not where he perceives it to be.[4,5]

When a pitcher throws a curve with an overhand delivery, topspin is produced. This results in a downward deflection or "drop" of the ball.[6] When a pitcher throws with a sidearm delivery, the ball moves horizontally as it crosses the plate. Most pitchers adopt what is termed a "three-quarter delivery." The arm is swung through an arc that is roughly halfway between vertical and horizontal. This delivery applies the sidespin and topspin components to a curve ball. For a right-handed pitcher, the ball moves diagonally from upper right to lower left.[7]

Little League batters who have become proficient at hitting a fastball often have great difficulty hitting a curve ball, because it requires more refined visual tracking, as well as the ability to see the rotation of the seams on the ball. The ability to recognize the rotation of the seams is often used to teach players how to "see" an approaching curve ball – since the spin itself creates the appearance of a red dot. The ability to hit a curve ball at this level of competition is not only very desirable, but is considered a necessary skill for all players, from the Little League Majors all

the way through high school, college, and even at professional levels.

The present study examines whether use of the EYEPORT[TM] vision training system can result in improved performance of Little League baseball players to successfully hit curve ball pitches.

## SUBJECTS

A sample of 15 male Little League players, age 12, participated in this study to assess the effect of using the EYEPORT™ on batting performance. See Table 1. Of these, 12 completed the study. The subjects were determined, by questioning, to be visually asymptomatic and two of them, players # 10 and #11 wore glasses. Numbers 10 and 11 wore their glasses during the pre test, but only #10 wore them for the post test. Number 11 had stopped wearing his glasses when playing baseball during the interim from pre to post test.

A written consent and release of liability form was signed by one parent of each subject to ensure that participants would discontinue participation and contact the instructor immediately if they experienced any adverse reactions to EYEPORT™ use. These subjects also consented to having the data that was collected on them published. Each participant agreed to read the EYEPORT™ manual and agreed to the stated terms of use.

## MATERIALS

The EYEPORT™[a] (Figure 1, page 146) is a 36" machine that has 12 light emitting diodes (LEDs) positioned in a row of alternating colors of red and blue. It can be rotated into horizontal, vertical and oblique positions. The primary purpose of the device is to improve visual tracking.

The EYEPORT™ is a patented product that is designed to aid in training the processing speed, accuracy and efficiency of vision. The colored LEDs are preprogrammed to turn on and off in different patterns and speeds. There are three programs, which vary the pattern of lights blinking: Program 1 is linear, Program 2 is alternating and Program 3 is random. The lights are illuminated at one of ten different rates, or speeds (0-9). There is an additional audible beep setting that coincides with each light being illuminated. The basic task for the subject is to visually track the lights as they illuminate, as accurately and quickly as possible.

Each EYEPORT™ vision training system includes reversible glasses with red and blue lenses which are worn during the training. The glasses are used to train each eye independently of the other. It is proposed that this effectively allows the non-dominant eye to become more efficient, creating a more balanced visual system. The use of red and blue lights is a unique and important aspect of the system and is based on chromatic aberration. This causes red light to focus in a more hyperopic position than blue light.[8] Thus, red light causes the eye to accommodate in the interest of clarity, while blue light causes a relative relaxation of accommodation. By alternately viewing these colors, a "rocking" action that stimulates and relaxes the eye's focusing system is created.

## METHODS

### Informational meeting

Each subject was given an EYEPORT™, and an explanatory manual[9] to take home for the period of the study. Prior to use of the EYEPORT™, an informational meeting was held in Davis, CA, to explain how the system functions and its intended use, to the subjects and their parents. The meeting was led by a

| Table 1. Information about subjects and their performances before and after EYEPORT training | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Player Information | | | | | | | Batting Performance Before EYEPORT | | | | | Batting Performance After EYEPORT | | | | | Results | |
| No. | Sex | Birth date | Rx | Bats | Throws | Pref eye | Test date | Hits | Fouls | Misses | Total (hits+ 0.5 fouls) | Test date | Hits | Fouls | Misses | Total (hits+ 0.5 fouls) | % change hits only | % change hits & fouls |
| 1 | M | 3/92 | N | R | R | R | 8/6/04 | 4 | 5 | 31 | 6.5 | dropped out | | | | | | |
| 2 | M | 5/92 | N | R | R | R | 8/6/04 | 18 | 20 | 2 | 28.0 | dropped out | | | | | | |
| 3 | M | 2/92 | N | R | R | R | 8/30/04 | 11 | 23 | 6 | 22.5 | 10/6/04 | 34 | 6 | 0 | 37.0 | 209 | 64 |
| 4 | M | 10/91 | N | R | R | R | 8/10/04 | 19 | 16 | 5 | 27.0 | 10/6/04 | 35 | 3 | 2 | 36.5 | 84 | 35 |
| 5 | M | 9/91 | N | R | R | R | 8/6/04 | 22 | 16 | 2 | 30.0 | 10/6/04 | 33 | 7 | 0 | 36.5 | 50 | 22 |
| 6 | M | 7/92 | N | L | R | L | 8/6/04 | 7 | 24 | 9 | 19.0 | 9/11/04 | 21 | 13 | 6 | 27.5 | 200 | 45 |
| 7 | M | 3/92 | N | R | L | R | 8/6/04 | 26 | 13 | 1 | 32.5 | 9/11/04 | 34 | 4 | 2 | 36.0 | 31 | 11 |
| 8 | M | 6/92 | N | R | R | R | 8/6/04 | 26 | 5 | 9 | 28.5 | injured | | | | | | |
| 9 | M | 6/92 | N | R | R | L | 8/6/04 | 30 | 10 | 0 | 35.0 | 8/30/04 | 38 | 0 | 0 | 39.0 | 27 | 11 |
| 10 | M | 2/92 | Y | R | R | R | 8/6/04 | 22 | 12 | 6 | 28.0 | 9/11/04 | 34 | 2 | 2 | 36.0 | 55 | 29 |
| 11 | M | 10/91 | Y | R | R | R | 8/10/04 | 18 | 13 | 9 | 24.5 | 9/11/04 | 27 | 5 | 5 | 31.0 | 50 | 27 |
| 12 | M | 1/92 | N | R | R | R | 8/30/04 | 19 | 17 | 4 | 27.5 | 10/6/04 | 26 | 5 | 5 | 30.5 | 37 | 11 |
| 13 | M | 5/92 | N | R | R | R | 8/6/04 | 0 | 2 | 38 | 1.0 | 9/11/04 | 0 | 38 | 38 | 1.0 | 0 | 0 |
| 14 | M | 2/92 | N | R | R | L | 8/10/04 | 7 | 14 | 9 | 14.0 | 8/30/04 | 28 | 1 | 1 | 33.5 | 300 | 139 |
| 15 | M | 7/92 | N | R | R | R | 8/30/04 | 22 | 16 | 2 | 30.0 | 10/6/04 | 30 | 0 | 0 | 35.0 | 36 | 17 |

*The preferred eye was determined by asking the players to make a circle with their thumb and index finger and frame the investigators face. The investigator noted which eye the player preferred.*
*Average improvement in number of hits for the 12 players: 90%.*
*Average improvement in number of hits and fouls for the 12 players: 34%*

trained, practicing vision educator, while the EYEPORT™ inventor, an optometrist, was simultaneously made available via conference call for any questions. After the discussion period, the vision educator trained each subject with an EYEPORT™, ensuring that the subject understood how to use the system. Subjects were instructed not to wear ophthalmic lenses or contact lenses during the training. The instructions were to do a daily 10-minute session on the system according to the schedule on the EYEPORT™ Vision Training Log (Appendix 1) for six days per week for three weeks.

### Initial testing phase

This phase involved having all players hit 40 pitches in the same batting cage. This work was conducted in Davis, California, during August 2004 on three days with hot, dry, sunny weather. This weather is typical for Davis in the summer, and comparable weather conditions also occurred when the players returned to the batting cage after EYEPORT™ training.

In the initial, as well as the testing (see below) phase of the study, 40 curve ball pitches were sequentially fed from the automatic pitching machine to each subject. The pitching machine was set to throw an overhand, or 12/6 curve ball, which creates a vertical drop in the pitch. The distance from the machine to the plate in the batting cage was 46 ft., the official Little League pitching distance. The pitching machine was set at 50 mph. Subjects used their own equipment (bat, hat, and batting helmet) and were instructed to swing at every pitch. The total number of misses, hits, and foul balls were recorded for the 40 pitches thrown to each player in the batting cage. A foul ball constituted a foul tip, pop up, chopper (a ball hit on the ground), or a ball hit at an extreme angle that would likely land in foul territory. A foul tip, pop up and chopper are easily recognized. Balls that were hit solidly were called hits unless the ball left the bat at an extreme angle and hit the cage within three feet of the batter.

### Training phase

The instrument has programs that increase in complexity; thus, Program 1 is used the first week, and Program 3 the third. The speed at which the LEDs illuminated was increased within each week. Appendix 1 shows these and other aspects

of the training protocol. The manual the subjects received explained both the programs and the speed settings.[9] An auditory beep accompanied the lighting of the LED in all programs.

In order to minimize external influences on performance during the study, there were no scheduled games or practice sessions, and none of the players had independent batting practice. Three participants dropped out of the study so that 12 subjects completed it.

### Final testing phase

In September 2004, the 12 players were again given a series of 40 pitches under comparable environmental conditions, with the same equipment, in the same batting cage with the same pitching machine and curve ball settings that were used in the August testing. The total number of hits, fouls and misses were again tallied.

### First analysis of data

The data we report is for the 12 subjects who completed this study. The data was analyzed twice, each time using a two-tailed, paired sample T-test[10]. In the first analysis, a comparison was made of successful hits before and after EYEPORT training, pairing each subject's score. Each solid hit was given a point value of one; fouls and misses were not credited. The null hypothesis is that there was no difference in the means of the paired scores before and after the use of the EYEPORT; the alternative hypothesis is that the mean difference was not equal to zero.

### Second analysis of data

In this analysis a similar comparison was made; however this time each hit was given a point value of one and each foul a point value of 0.5. While a foul is considered a strike in play, it also signifies to the coach that the batter is "on the ball", and as such, closer to hitting the ball squarely than when the player swings and misses. In the progression of a batter swinging and missing to swinging and solidly hitting the ball, a foul is somewhere in between; thus the value of 0.5 was assigned each foul for this analysis. The null hypothesis again was that there is no difference in the means of the paired scores before and after the use of the EYEPORT™; the alternative hypothesis is that the mean difference

was not equal to zero. The data for both analyses are presented in Table 1.

### Results of first analysis

The average improvement in hitting, counting solid hits only, for the 12 players was 90%. The paired T-test conducted on hits only is highly significant ($t_{0.05\ (2)\ 11}$= 6.219, p = 0.000). There is a mean difference of 11.416 between the before and after scores, indicating that the mean number of successful hits per subject, after using the EYEPORT™ vision training system ($\mu$ = 28.333) was greater than the mean number of hits before using the system ($\mu$ = 16.917). See Figure 2.

### Results of second analysis

The average improvement in hitting when *including solid hits and fouls* in the analysis, with scoring as described above, was 34%. The results of the second paired T-test on hits and fouls was also highly significant ($t_{0.05\ (2)\ 11}$= 4.804, p = 0.001), with a mean difference of 7.375. This indicates that the mean number of successful hits and fouls per subject, after using the EYEPORT vision training system ($\mu$ = 31.625) was more than the mean number of hits and fouls before using the system ($\mu$ = 24.250). See Figure 3.

Our results clearly demonstrate an improvement in the ability of these little league players to hit curve balls, after using the EYEPORT™ vision training system.

### DISCUSSION

The results of this study, improved performance in hitting curve balls after the use of the EYEPORT™, are promising. The use of the system apparently has the potential to help Little League baseball players improve their batting skills in the absence of coaching or practice. It further suggests the importance of visual aiming, tracking and focusing to optimal batting performance.

Nevertheless, the present study is not without limitations: The sample size was relatively small and the study was conducted without a control (untrained) group. There was also the potential for a practice effect to be induced by the preliminary (August) trial in the batting cage, before EYEPORT™ training. However, Little League players typically practice for a minimum of one to two hours. several days a week to improve their hitting performance, so the effect of a one-time

Figure 1. EYEPORT™ in the horizontal position, with the red and blue diodes visible.

batting cage hitting session was likely quite minimal.

The intention of the investigators was for all subjects not to practice baseball, and to complete the use of the training system in three weeks. As it turned out, five of the subjects missed a few training sessions during the initial three weeks and had to extend their training for one week, in order to complete a total of 18 sessions. During this week, these five players attended one throwing practice, during which time no hitting or fielding occurred. Playing catch (throwing and catching a baseball) requires a very different level of skill than hitting. Since hitting a baseball, particularly a curve ball, requires a much more finely developed level of visual tracking, depth perception and eye-hand coordination, it is unlikely that a single throwing practice had significant effect on the outcome of this study. However, to completely eliminate the possibility of improvement due to factors other than improved visual skills through EYEPORT™ use, a larger study with both a treatment group and a control group in which all participants do not engage in any baseball practice is required.

Baseball is a complex sport and performance in a batting cage may not always be a good indicator of performance in actual playing conditions. However, as the Davis High baseball coach, Dan Ariola, pointed out to the investigators, due to the many different situations occurring in a baseball game, comparing statistics such as batting averages, on base percentage or slugging percentage, may not be the best indicator of hitting skill either. For example, a manager may signal for a batter to take a pitch (not swing), or hit-and-run (swing and hit the next pitch regardless of where it is thrown), or sacrifice bunt. Sometimes a new pitcher will be brought in to pitch to a particular batter or a batter will be intentionally walked. Although batting statistics are calculated for many
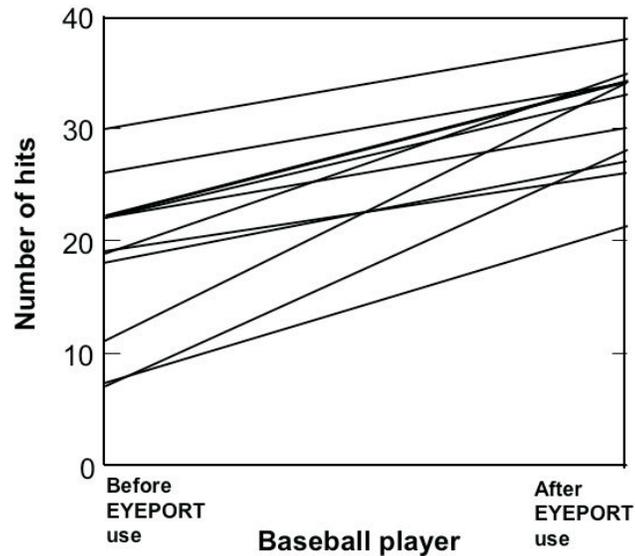


Figure 2. Graph depicting each subject's total number of solid hits before and after use of the EYEPORT™ vision training system. Each individual's score before the training program is connected, by a line, to his score after the training program.
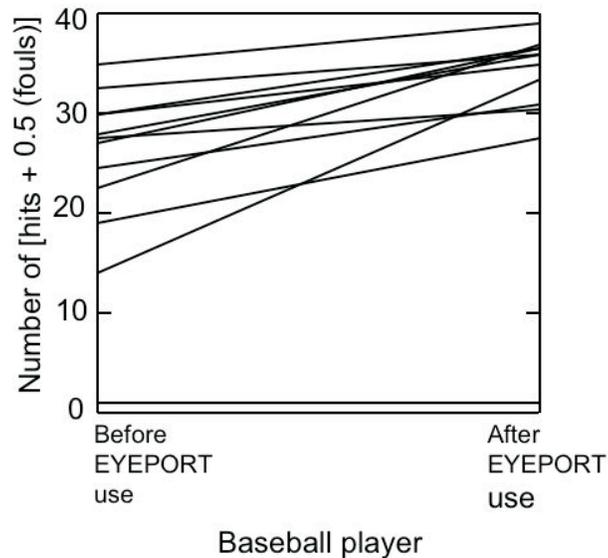


Figure 3. Graph depicting each subject's total number of hits and fouls before and after using the EYEPORT™. Each subject's score before the training program is connected by a line, to his score after the training program.

baseball players, the numerous situations which can arise in a baseball game will alter the statistics. Therefore, in baseball, batting statistics are only one piece of information that is used to determine a player's ability. However, as is true for most scientific studies, initially isolating the present variable of interest (hitting performance) so that it is not confounded by other factors is warranted. This is the reason performance was tested in a batting cage.

Limitations of this study stated, one must appreciate the magnitude of the improvements that were shown several weeks immediately following the use of the vision training system.

In summary, this study results demonstrate a substantial improvement in the ability of these subjects to hit curve balls after using the EYEPORT™ vision training system. The results from this study are promising and potentially important to many little league players and athletes in other sports (*e.g.* tennis, golf, basketball players), as well as others whose occupations require high-level visual skills and would benefit from improvement in their visual performance.

## ACKNOWLEDGEMENTS

## SOURCE

a. Website of the EYEPORT system: www.exerciseyoureyes.com

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Corresponding author:
Teresa Bowen, M.S.
2708 Rockwell Drive
Davis, California 95616
tbowen@sbcglobal.net
Date accepted for publication:
October 25, 2005

## Appendix 1. EYEPORT™ vision training practice log.

**Name:**

### Week 1

| Day | Date | Program | Speed | Auditory | EYEPORT horiz. ↔ | EYEPORT vertical ↕ | EYEPORT diag. ＼ | EYEPORT diag. ／ | EYEPORT near-far ✕ | EYEPORT Batter's box See Note 4 below |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 1 | 2 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 2 | | 1 | 2 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 3 | | 1 | 3 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 4 | | 1 | 3 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 5 | | 1 | 4 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 6 | | 1 | 4 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |

### Week 2

| Day | Date | Program | Speed | Auditory | EYEPORT horiz. ↔ | EYEPORT vertical ↕ | EYEPORT diag. ＼ | EYEPORT diag. ／ | EYEPORT near-far ✕ | EYEPORT Batter's box See Note 4 below |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 2 | 2 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 2 | | 2 | 2 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 3 | | 2 | 3 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 4 | | 2 | 3 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 5 | | 2 | 4 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 6 | | 2 | 4 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |

### Week 3

| Day | Date | Program | Speed | Auditory | EYEPORT horiz. ↔ | EYEPORT vertical ↕ | EYEPORT diag. ＼ | EYEPORT diag. ／ | EYEPORT near-far ✕ | EYEPORT Batter's box See Note 4 below |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 3 | 2 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 2 | | 3 | 2 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 3 | | 3 | 3 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 4 | | 3 | 3 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 5 | | 3 | 4 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |
| 6 | | 3 | 4 | 1 | Red/R | Red/L | Red/R | Red/L | No glasses | No glasses |

The subjects were instructed to enter the date when the procedures were done in the second column for each week. The instrument orientations in columns 6 through and including 9 were in the vertical plane and situated 24 to 30 inches from the subjects. The instrument orientations for columns 10 and 11 were in the horizontal plane. The instructions for column 10 (near-far) were for the subject to hold the instrument by its handle so that the near end was between the nose and lip and that the instrument was perpendicular to the face. The instructions for column 11 (Batter's box) were for the subject to orient the body in his batting stance. The subject then held the instrument by its handle. The near end was to be placed on the face, pointing in the direction that simulated the path a pitched ball would take for the subject. For example, a right hand batter would hold the unit in the left hand with the near part of the unit placed on the left side of the face.

"No glasses" in columns 10 and 11 meant that the red/blue filters were not to be worn.