# The Relationship of Eye Dominance and Baseball Batting: a Critical Literature Review

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### Abstract

*One of the visual factors hypothesized to be related to baseball batting performance is the relationship of dominant eye and batting side. This paper reviews the four studies that have investigated this possible relationship. The two studies with the largest sample sizes found no effect of dominance pattern on batting performance. One small study found better on-base percentage in uncrossed dominant players, but no difference in other measures of batting performance. Another small study found the lowest batting average in uncrossed dominant players, but there was no report of whether statistical significance of the difference was reached. Dominance pattern does not appear to be related to batting performance. Theoretical issues relating to this question are discussed.*



### Key Words

*baseball, eye dominance, sports vision, visual skills.*


Hitting a pitched baseball effectively is an extremely complex hand-eye coordination task. The attributes of the visual system which are related to successful batting have not been identified. It has been suggested that batting performance is related to whether or not the dominant eye and the batting side of the plate are on the same side.

The purpose of this paper is to critically review the four published papers on the effect of the dominant eye-batting side relationship on batting performance. In each of these studies eye dominance was determined by some form of sighting test, in which the eye used to align a finger or an aperture with a more distant object is determined. The situation in which the batting side and the side of the dominant eye are the same (right-handed batter with right eye dominant or left-handed batter with left eye dominant) is generally referred to as uncrossed dominance. The situation with batting side and the side of the dominant eye opposite (right-handed batter with left eye dominant or left-handed batter with right eye dominant) is called crossed dominance.

### Study by Adams

Adams,[1] a faculty member at the University of California Riverside, studied batting performance of 32 varsity baseball players on the University of California Los Angeles and California State Polytechnic College teams. Four subjects were not included in the analysis due to an insufficient number of at bats. All subjects had normal visual acuity with both eyes viewing. Eye dominance was determined by two sighting tests which gave the same results on the 32 subjects. On one test the subject held a pencil at arm's length and aligned it with a half-inch-diameter black dot on a wall seven feet away from the subject. The other test was the hole in the card test. The subject held a cardboard square 11 inches on each side and with a quarter-inch-diameter hole in the center at arm's length in both hands and aligned the hole in the card with a half-inch-diameter white dot on a blackboard seven feet away. Eighteen subjects had uncrossed dominance, 16 of them being right handed-batters. Ten subjects were crossed dominant, seven batting right-handed.

The UCLA team played 40 games, and the Cal Poly team competed in 32 games. The mean number of at bats was 88, with a median of 74 and a range of 32 to 163. Five batting performance measures were calculated: (1) Missed swing percentage was the number of times the batter missed the ball divided by the total number of swings (these data were available only for the 16 UCLA players). (2) On base average was the total number of times on base including errors and fielders' choices divided by the total number of plate appearances. (3) Strikeout percentage was the number of strikeouts divided by the total number of at bats. (4) Called strikeout percentage was the number of called strikeouts divided by the total number of at bats. (5) Batting average was computed in the standard fashion.

The study results are displayed in Table 1. The only batting performance measure which showed a statistically significant difference between the two groups by a chi-square test was on base average. The 18 uncrossed dominant subjects got on base 669 times in 1,821 times at bat for a .367 average. The 10 crossed dominant players were on base 203 times out of 638 at bats for a .318 average.

**Table 1. Batting performance statistics from Adams.[1]**

| Batting statistic | Uncrossed dominance | Crossed dominance |
|---|---|---|
| On-base average | .367 | .318 |
| Batting average | .284 | .246 |
| Strikeout percentage | 15.8% | 15.7% |
| Called strikeout percentage | 4.6% | 4.1% |
| Missed swing percentage | 21% | 17% |

### Study by Portal and Romano

Portal and Romano,[2] two physicians at the University of Florida, determined eye dominance and handedness for 23 players on the University of Florida baseball team and for a group they referred to as normal controls. The characteristics of the 100 normal controls were not given. Eye dominance was determined by the pointing sighting test, in which the examiner closes one eye and the subject points with extended hand to the examiner's open eye.[3] The examiner identifies the subject's eye which is aligned with the pointing finger as the dominant eye. This test is unique in that some subjects are identified as having central ocular dominance by having their finger aligned with a point between the two eyes.[3] It was not stated whether handedness referred to batting side or throwing hand.

The patterns of dominance were compared in the players and the controls. Thirty-five percent of the players were crossed dominant, compared to 18% of the controls, a difference which was statistically significant at the .01 level. Table 2 gives the distribution of dominance in the two groups and the players' batting averages for the different dominance groupings. There was no statement in the paper concerning statistical significance of the differences in batting average. Because there were only six, eight, and nine players in the three dominance categories, it is unlikely that clear conclusions can be made concerning differences in batting averages in the three dominance groups.

**Table 2. Distribution of dominance and batting average in the Portal and Romano study.[2]**

| Dominance pattern | Number of normal controls | Number of players | Players' batting averages |
|---|---|---|---|
| R eyed, R handed | 60 | 7 (30%) | |
| L eyed, L handed | 5 | 2 (9%) | |
| total uncrossed dominance | 65 | 9 (39%) | .250 |
| R eyed, L handed | 16 | 6 (26%) | |
| L eyed, R handed | 2 | 2 (9%) | |
| total crossed dominance | 18 | 8 (35%) | .310 |
| C eyed, R handed | 15 | 5 (22%) | |
| C eyed, L handed | 2 | 1 (4%) | |
| total central ocular dominance | 17 | 6 (26%) | .340 |
| Total | 100 | 23 (100%) | |

**Table 3. Mean batting averages in the college players in the Milne et al. study.[4]**

| Dominance pattern | Number of players | Batting average | Standard deviation |
|---|---|---|---|
| Uncrossed dominance | | | |
| R eyed, batted R | 148 | .296 | .059 |
| L eyed, batted L | 39 | .306 | .078 |
| Crossed dominance | | | |
| L eyed, batted R | 16 | .284 | .109 |
| R eyed, batted L | 31 | .312 | .089 |

### Study by Milne et al.

Milne, a faculty member in Department of Physical Education, Recreation and Dance at New Mexico State University, and colleagues[4] studied dominance in 234 varsity baseball players from 12 teams in the top 20 teams in the 1993 NCAA Division I rankings and four teams in the Big West Conference and 124 youth baseball players from a local league. The college players averaged 20.71 years of age (SD = 1.24). The youth players had a mean age of 13.20 years (SD = 0.77). Eye dominance was determined by the hole in the card test and by a very similar test in which an aperture is created between the two hands with arms outstretched by holding the hands together with palms away from the face. The upper boundary of the aperture is thus formed by the eight fingers, the left boundary by the left hand, the right boundary of the aperture by the right hand, and the lower boundary by the two thumbs. Batting side was self-reported by the players. For the purpose of analysis switch-hitters were considered to bat on the side on which they had the better batting average.

The batting averages of the groupings by dominant eye and batting side are shown in Tables 3 and 4. Statistical testing by analysis of variance indicated that dominance status in the four categories in the tables did not have a significant effect on batting average.

**Table 4. Mean batting averages of the youth league players in the Milne et al. study.[4]**

| Dominance pattern | Number of players | Batting average | Standard deviation |
|---|---|---|---|
| Uncrossed dominance | | | |
| R eyed, batted R | 99 | .251 | .113 |
| L eyed, batted L | 1 | .222 | — |
| Crossed dominance | | | |
| L eyed, batted R | 9 | .313 | .190 |
| R eyed, batted L | 15 | .304 | .077 |

**Table 5. Mean batting averages in the Classé et al. study.[5]**

| Dominance pattern | Number of players | Batting average |
|---|---|---|
| Right handed batters | | |
| R eyed | 44 | .234 |
| L eyed | 20 | .236 |
| Left handed batters | | |
| R eyed | 17 | .249 |
| L eyed | 11 | .242 |
| All batters | | |
| uncrossed dominance | 55 | .239 |
| crossed dominance | 37 | .242 |

## Study by Classé et al.

A group of optometrists from the University of Alabama Birmingham[5] performed a vision screening on 215 of the 234 players in the Southern League. Eye dominance was determined by having the players make an aperture between their two hands with extended arms, as was done by Milne at al.[4] Mean batting averages were determined in four dominance categories for 89 players who were not pitchers and who had at least 50 at bats. These averages are shown in Table 5. The relationship between dominance pattern and batting average was not statistically significant.

## Discussion of Study Results

The Adams[1] study reported significantly better on-base average in uncrossed dominant players, but no difference in batting average, strikeout percentage, called strikeout percentage, or missed swing percentage. Better performance by players with uncrossed dominance is opposite to the theories commonly proposed today. They had 28 college players as subjects.

Portal and Romano[2,3] presented batting averages for 23 college players. Batting average was numerically highest for the central ocular dominance group, lowest for the uncrossed dominance group, and intermediate for the crossed dominant dominance group. The numbers of players in each group was small, and no statistical analysis of the difference between groups was reported.

The other two studies had larger number of subjects: Milne et al.[4] studied 234 college players and 124 youth league players, while Classé et al.[5] observed 89 minor league players. Neither of these studies found a significant effect of the eye dominance-batting side relationship on batting average. Therefore, the available studies do not suggest an effect of the dominant eye/batting side relationship on batting performance.

One potential limitation of most of these studies is that they used a highly selected sample to investigate. That is, by using college or professional players they were studying players with a high level of batting proficiency compared to the general population. It is possible that an advantage of a particular dominance pattern would be less important in a highly skilled group than in a less skilled group.

## Study on the Correlation of the Dominant Eye/Throwing Hand Relationship with Batting Average

Two optometrists from Philadelphia[6] determined eye dominance with the hole in the card test and subjectively assessed eye movements in 50 male Little League baseball players, ages 11 to 13 years. The players with the top 15 batting averages all had their dominant eye and throwing hand on the same side (12 right-handed, three left handed). Six of the 10 players with the lowest batting averages had their dominant eye and throwing hand on opposite sides. They did not report any data on batting side. The best hitters were judged to have the best eye movement skills.

## Would Eye Dominance be Expected to be Related to Batting Performance on a Theoretical Basis?

During everyday activities people with normal binocular vision fuse the images formed by the two eyes efficiently and without conscious effort. In ocular dominance testing, a special task is performed which forces an individual to observe the dominance of one eye over the other. Coren and Kaplan[7] determined the dominant eye on 57 subjects using 13 different tests. The same eye was not always dominant on different tests, but they were able to cluster similar results into three categories of dominance tests. They proposed the classification of dominance tests into at least three types based on the type of task: (1) sighting dominance, in which the eye chosen to align with two other points is determined; (2) sensory dominance (sometimes called rivalry dominance) in which different images are projected by some means into the two eyes, and the image reported as being seen the most often identifies the dominant eye, and (3) acuity dominance, in which more information appears to be gained from one eye than the other in less than optimal stimulus conditions.

Gronwall and Sampson[8] performed 16 different eye dominance tests, including five sighting dominance tests, on 50 subjects between the ages of 17 and 22 years. They found that the results on the five sighting tests correlated well with each other, but not with the other types of eye dominance tests. However, they did not identify a clear classification of the other dominance tests. They suggested that for sighting dominance tests, "eye preference" would be better terminology than "eye dominance" because the latter implies a superiority of one eye over the other.

The four studies reviewed here used sighting dominance. In testing sighting dominance, one eye must be used to align two objects at different distances from the subject. In hitting a baseball both eyes view the ball, unlike the visual conditions on a sighting dominance test. Because the alignment of one visual target with another or alignment of an object through an aperture is not part of the task of hitting a baseball, it is not immediately obvious why sighting dominance should have some relationship to batting performance.

One hypothesis for a better batting performance with crossed dominance suggests that visual information is processed faster by the dominant eye than by the other eye. Thus it has been argued that there would be a very small fraction of a second advantage if the dominant eye was closer to the pitcher. Coren and Porac[9] had 38 subjects adjust an auditory click to appear to be simultaneous with the onset of a visual stimulus. The latency for the dominant eye determined by sighting tests averaged 14 msec less than the latency for the non-dominant eye. However, Classé et al.[10] found that visual reaction time was not significantly different between the dominant and non-dominant eyes in minor league baseball players. Furthermore, even if a difference in visual processing speed exists between the dominant and non-dominant eyes, the inconsequential distance between the two eyes in comparison to the speed of light makes this hypothesis specious.

Another theory for better batting with crossed dominance suggests that the batter's nose or brow may obstruct the view of the pitcher and that therefore the dominant eye should be closer to the pitcher. This would be a factor only if the batter had a closed stance, and did not turn his head toward the pitcher. With apparently no or perhaps rare exception, skilled batters turn their heads to have a binocular view of the pitched ball. In the unlikely situation of batters not turning their heads sufficiently to binocularly view the pitch, players with uncrossed dominance and an open stance might be expected to perform better than players with uncrossed dominance and a closed stance.

The Adams study[1] included six uncrossed dominant players who used an open stance all season and six who used a closed stance all season. They did not show a statistically significant difference in on-base average, batting average, or called strikeout percentage. The players with open stances did have a lower strikeout percentage (12.8% vs. 18.2%). Milne et al.[4] used an analysis of variance statistical test and found no effect of dominance relationship (crossed vs. uncrossed) and batting stance (open, normal, or closed) on batting average.

## Is Crossed Dominance More Common in Baseball Players than in the General Population?

It has been suggested anecdotally that crossed dominance is more common among baseball players than among the general population. If so, it could be suggested that the players have continued in baseball in part because of the advantage gained by having crossed dominance. Another potential explanation for a greater prevalence of crossed dominance among baseball players is that there are more left-handed batting baseball players than left-handed people in the general population, while the distribution of eye dominance is the same among baseball players and the general population.

We can first compare prevalences of crossed dominance in the baseball players in the studies discussed previously to the prevalences of crossed dominance in other studies. Among the baseball players in the Adams study,[1] 36% (10 of 28) were crossed dominant. The college players in the Portal and Romano study[2] had a prevalence of crossed dominance equal to 47% (8 of 17) when those with central ocular dominance were excluded. The group of college players investigated by Milne et al.[4] were 24% crossed dominant (55 of 234). For comparison, Hebben et al.[11] found 31% (55) of 191 children to be crossed dominant using sighting dominance tests and a 17-item handedness questionnaire. Rengstorff[12] reported a prevalence of crossed dominance of 33% in 5,546 subjects, ranging in age from 5 to 75, most of whom were clinic patients. Eye dominance testing was done with the hole in the card test, and subjects were asked whether they were right-handed or left-handed. In a study of 1,005 clinic patients from 4 to 82 years of age, Robison et al.[13] found 41% to be crossed dominant by a sighting test and asking the patients about their hand dominance. Based on these particular samples there does not appear to be an obvious difference between the dominance pattern of batting side/dominant eye among college baseball players and the dominance pattern of preferred hand/dominant eye in the general population.

The Southern League players examined by Classé et al.[5] were 40% crossed dominant (37 of 92). In testing done in 1980 with the tube sighting test in 270 players with seven major league baseball teams, Teig,[14] a Connecticut optometrist, found 50% to have crossed dominance of dominant eye and batting side. It appears that there may be a higher prevalence of crossed dominance in professional players than in the general population.

Right eye dominance by sighting tests is more common than left eye dominance. In the Hebben et al.[11] study, 69% of 191 children were right-eyed. Rengstorff[12] found 66% of over 5,000 people to have the right eye as their dominant eye. Robison et al.[13] found 58% of their sample to be right eye dominant. Porac and Coren[15] summarized the results of 11 studies of sighting dominance, and found them to be remarkably consistent in finding within a few percentage points of 65% of people to be right eye dominant. In the Adams study of college baseball players, 68% of 28 were right eye dominant. Omitting the subjects with central ocular dominance, 76% (13) of 17 college players tested by Portal and Romano were right eye dominant. In the Milne et al. sample of 234 college baseball players, 76% were right eye dominant. The youth league sample of Milne et al. seems to be an unusual one in having 92% (114 of 124) right eye dominant. The players in the Southern League studied by Classé et al. were 66% (61 of 92) right eye dominant. Teig[14] did not provide the numbers of professional players with right eye dominance or left eye dominance.

There are proportionately more left-handed batters in baseball than left-handed people in the general population, presumably because of the advantage of getting to first base faster from the left side and/or the advantage of left-handed batting against right-handed pitchers. This would make crossed dominance more common among baseball players if the prevalence of right eye dominance was the same in baseball players as in the general population.

## Comments and Conclusions

Overall the studies reviewed do not suggest an effect of the eye dominance/batting side relationship on batting performance. Neither are there strong theoretical grounds to suggest that such an effect should be expected. It appears that other measures of visual system function, such as visual reaction time,[10] eye movement skills,[16] or dynamic stereoacuity[17] may be more likely to correlate with batting performance.

Left-handed hitters had slightly better batting averages among the college players in the Milne et al. study[4] and among the minor league players in the Classé et al. study.[5] The authors did not report whether these differences were statistically significant. Changing a right-handed batter into a left-handed batter, or converting a batter into a switch-hitter, may be justified for various reasons, such as the left handed batter being closer to first base, or the switch hitter not having to face a pitcher throwing from the same side as his batting side. However, based on current knowledge, it does not appear that sighting eye dominance pattern is a valid reason for switching a player's batting side.

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*EDITORIAL continued from page 86*

scholarliness, logic and editorial oversight, the optometric practice of vision therapy is characterized as quackery.[7] Vision therapy has been attacked before, but never so irresponsibly. And ophthalmology must realize that the future of the two professions are tied to each other. In today's health care economic environment, the business agents of managed care thrive on the lack of cooperation and coordination between ophthalmology and optometry. They are able to use the discord increasingly against both. The result has generally been decreasing reimbursement rates and compromised patient care, with the only winners being the treasuries of the managed care plans.

But realistically, a prerequisite for ophthalmology to take such a rational course is a reciprocal action by optometry; this can not be a one-way street. While ophthalmology, which has changed so little, will need to institute major revisions, optometry, which has changed so much, will need to do a critical self-assessment. And the key issue will be the degree to which further changes in its scope of practice are presently desirable and feasible. This assessment must be done in the context of the maintenance of its vitality, the fact that ophthalmology will not disappear, and, most important, the public good.

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