

Research article

Eye Dominance Difference Connection to LD Learning Disabilities

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Abstract

When using the right and then left hand with two different hand positions- to sight a small X target 10- FT away, eye dominance difference becomes quite apparent. Using an opportunistically found sample population of n=1120 subjects, the majority of eye dominance combinations was found to be mixed. After eliminating subjects n=122 due to not sighting in one or more positions, the remaining population of n=998 demonstrate that 45% of the population is totally right or left eye dominant and 55% of population is found with mixed sighting dominance when using this testing method. This is even though 70% of total population initially demonstrates using a preferred right eye. The testing procedure produces sixteen possible eye dominance combinations patterns. n=133 or 13% of the sample are found all left eye dominant. Starting with a left eye being dominant and three other possibilities produces n=356 or 36% of the population. Using a right eye as the first position found and three other combinations produces n=195 or 20% of the total population. The remaining group of all right eye dominance n=314 or 32% of the total population. n=119 or 12% of the population of n=998 were identified as having a reported learning disability (LD). In three mixed eye dominance patterns n=starting with a right eye n=102, almost no LD was present. In a different group of mixed patterns starting with a left eye n=64, 23% LD identification was reported. **Copyright © acascipub.com, all rights reserved.**

Keywords: Ocular Dominance; Visual Dominance; WLD; Written Language Disability; LD; Learning Disability, RPS; reversed positioning sensation; ADD, Attention Deficit Disorder, ADHD, Attention Deficit Hyperactivity Disorder, Dyslexia

Introduction

Ocular or visual dominance refers to asymmetric cortical bias for visual input from one eye over its fellow. Studies estimate that it is right-sided in 65.8-68% of healthy individuals.6-7. Left-sided ocular dominance has been associated with having left-dominant parents.,4. However, a smaller body of work challenges the idea that ocular dominance, like handedness, is primarily right-sided. Hillemans studied a cohort which tested only 40% right-dominant,1 not the expected two-thirds. Given that a consensus gold standard for testing ocular dominance does not exist, Seijas recently gave 12 different tests to 51 and -test agreement was low and Rice tested 46 subjects using four tests of ocular dominance and agreed that inter-test agreement was moderate to only slight.3 These unexpected results suggest that our current understanding of ocular dominance is incomplete. From 1993 to 1999, Young and Ginsburg observed 1120 subjects with and without learning disability while studying visuomotor etiologies of reading disabilities.12,13. Collected data from each subject included a 35-item inventory (see appendix1), of which one item identified eye preference and four items assessed ocular dominance. Subjects had completed ocular dominance testing via two tests sighting through a circle formed by the thumb and index finger and the "Porta", know as the pointing a finger test. We now report

a secondary analysis of those items to investigate ocular dominance distributions across a large study population related to LD, Learning Disability.

Ocular Dominance Pattern	n	Gen der		Learning Disability	
		Male	Female	Present	Absent
Consistently Right	314 32%	173 55%	141 45%	38 12%	276 88%
Mixed First Sighting Right	195 20%	78 40%	115 60%	12 6%	183 94%
Mixed First Sighting Left	356 36%	158 44%	199 56%	54 15%	302 85%
Consistently Left	133 11%	74 56%	59 44%	15 11%	118 89%
Total	998	495	503	119	881

Chart showing gender difference and Reported Learning Disability to Tested Eye Patterns

Methods

An opportunistic sample of 1120 subjects in Connecticut and Arizona was drawn from students attending public and private elementary (n = 261) and middle schools (n = 150) and a State college (n = 350), their family members (n = 202), and adults from the general population (n = 157). Of these, 551 (49%) were male and 569 (51%) female. Inclusion criteria in the original study were: parental permission for minor children, access to school records, normal intelligence, normal vision and hearing, and English as primary language. All subjects were individually administered the Young-Ginsburg Lateral Direction Assessment (YGLD) (Appendix1), an instrument developed to assess a range of lateral visuomotor and perceptual patterns that were hypothesized to impact the development of successful reading skills and writing skills. Primary data collection included demographics, education history, and the 40-item YGLD inventory. Five of the first six of 40 items involved the assessment of hand-eye sighting position and ocular dominance (Appendix 1) using a sighting test to establish eye preference followed by two sighting tests in two different hand positions each (Items B1-C2). Subjects who used corrective lenses were encouraged to wear them. All tests were performed using a sighting target at eye-level, ten feet straight ahead.

(see appendix 1)

Arm Hand/Eye Dominance Test

Begin each test with arm being used out stretched

Circle—Find the eye that stays aligned to the (ten feet away)

target and in the circle that the subject has made with their thumb and index finger.

(Start with both eyes open, find the target, set position, and then close one at a time.)

1) Using the right arm; the eye on the target is (mark one):

a) right _____ b) left _____ c) neither _____

2) Using the left arm; the eye on the target is (mark one)

a) right _____ b) left _____ c) neither _____

Point—Repeat the procedure above in but now, point to the target

Now use the index finger and line it up to the target

1) Using the right arm; the eye on the target is (mark one):

a) right _____ b) left _____ c) neither _____

2) Using the left arm; the eye on the target is (mark one)

a) right _____ b) left _____ c) neither _____

Results

Because there is so large a difference between the mixed patterns starting with a right hand sighting (n=7) and the mixed patterns (n=7), starting with a left sighting, the fourteen mixed patterns are separated. By doing this, an interesting difference is found. Three groups in the left mixed group n=64 with two left sighting and then a lft/rt, rt/lft, and rt/rt sighting patterns produce a mean of 23% LD identification.

Charts showing difference in left and right visual dominance patterns

Left Eye Patterns

When using right- then left hand and two different hand positions- to sight a small X target 10- FT away							
Eye found used:		L=left eye	R= right eye				
Writing hand used**		l =left hand	r= right hand	population N= 998 ***			
sighting	% of total pop.						
pattern ID	N	Wr. hand	L.wr.hand	% difference**	prefer Rt eye	% difference*	LD
All left Eye							
LLLL		l=31	23%	n=49	37%	n=15 LD	(11%)
n=133	(13%)	r=102					
LLLR=18	2%	l=6	33%	n=8	44%	n=4	22%
		r=12					
LLRL=31	3%	l=6	19%	n=18	58%	n=8	26%
		r=25					
LLRR=15	2%	l=15	27%	n=8	53%	n=3	20%
		r=69					
LRLl=84	8%	l=12	18%	n=50	60%	n=13	15%
		r=61					
LRLR=73	7%	l=23	16%	n=59	81%	n=10	14%
		r=61					
LRRL=40	4%	l=8	20%	n=24	40%	n=7	18%
		r=32					
LRRL=95	10%	l=14	15%	n=76	80%	n=9	9%
		r=81					
Total mixed left eye						n= 54 LD	(15%)
n=356	(36%)						

Three groups in the right mixed groups n= 102 starting with rt/lft sightings then lft/lft, rt/lft and rt/rt, produce only n=3 LD identified subjects or .3%. There was also a group of Right/Left-Left/Right visual pattern n=17 with 4 LD students. n=119 or 12% of the total population of n=998 were identified as having a reported learning disability (LD)

Right Eye Patterns

Sighting	% of total pop.							
Pattern ID	N	Wr. hand	L.wr.hand	% difference**	prefer Rt eye	% difference*	LD	
Mixed beginning right eye								
RLLL=24	2%	l=4		17%	n=19	79%	n=1	4%
		r=20						
RLLR=17	2%	l=1		6%	n=13	76%	n=4	26%
		r=16						
RLRL=50	5%	l=6		12%	n=38	76%	n=1	2%
		r=44						
RLRR=28	3%	l=7		33%	n=21	75%	n=0	0%
		r=21						
RRLl=16	2%	l=4		25%	n=11	69%	n=1	6%
		r=12						
RRLR=20	2%	l=2		10%	n=16	80%	n=2	10%
		r=18						
RRRL=40	4%	l=7		18%	n=35	88%	n=3	7%
		r=13						
Total mixed right eye							n=12 LD	(6%)
n=195 20%								
All right eye						87%		
RRRR=314	32%	l=30		10%	n=272		n=38 LD	(12%)
		r=284						
*70% of total population initially demonstrates preferred right eye								
**Reported left handed if any left writing handedness was noted								
***Original population (n=1120: (n=122) eliminated due to not sighting in one or more positions								

Discussion

When we examined ocular dominance data from any one test item, there was apparent confirmation with previous estimates that the general population is two-thirds right-dominant.6-7 This was true for initial eye preference testing (70%) and the ocular dominance tests (mean, 61.9%). However, performance through the series of four tests, we arrived at a significantly different aggregate statistic: 55% of all subjects showed a mixed ocular dominance pattern. Previous authors reported that clear dominance could not be found 4 and others noted slight to moderate inter-test reliability when multiple dominance tests were administered.5 A previously published article, it was mentioned that several family members who had RPS (reversed positioning sensation) syndrome as described previous work, also had the mixed visual patterns starting with right hand/eye then left hand/left eye and no report of a diagnosed learning disability as found in the other significantly LD identified family members with RPS.16 The pattern right hand/right eye & left hand/left eye with both the point and circle test is found in 5%, n=50 of the sample of n=998 studied. There was only one LD subject found in this group, a very high IQ private middle school student. Interestingly there was also a group of Right/Left-Left/Right visual pattern n=17 with four LD students. Could possibly, the reversed visual point pattern have caused this? In spite of the four LD identified in a right/mixed pattern group n=17, the total right mixed pattern group still had by far the least number of LD subjects.

Conclusion

It has long been theorized that there is visual involvement in identified learning disabilities but never understood quite why. Could lateralized interactive visual dominance difference be one of the answers being looked for?

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Appendix 1

Subject ID Codes _____

Young-Ginsburg Lateral Direction Assessment (YGLD)

Name of subject _____ Date _____

School or Location _____ Class _____

I Visual Perceptual/Motor Interaction

A. Preference --- Finding the preferred hand with with the preferred sighting eye

1. Hand a. right_____ b. left_____

2. Eye a. right_____ b. left_____

B. Circle --- Find the eye that stays aligned to the target and in the circle that the subject has made with their thumb and index finger. (Start with both eyes open, find the target, set position and then close one at a time.)

1. Using the right arm; the eye on the target is (mark one):
a. right_____ b. left_____ c. neither_____

2. Using the left arm; the eye on the target is (mark one):
a. right_____ b. left_____ c. neither_____

C. Point --Repeat the procedure above in "B" but now point to the target
Now use the index finger and line it up to the target

1. Using right arm; the eye on the target is (mark one)
a. right_____ b. left_____ c. neither_____

2. Using the left arm; the eye on the target is (mark one):
a. right_____ b. left_____ c. neither_____

3. Do you often say and/or mean one direction but point in another? _____

D. Closing Eyes-

Has had trouble closing an eye (s) on B & C when using one eye at a time.

a. right_____ b. left_____ c. both_____

II Writing Hand

1. Uses the: a. right_____ b. left_____ c. either_____ hand for writing d. switched_____
2. Using the right hand, draw a line with loops in it on the line below. Start on either. (but just one) side of the "X"; Begin at the "X"

Start here V

_____X_____

3. Using the left hand, draw a line with loops in it on the line below. Start on either (but just one) side of the "X"; begin at the "X"

Start here V

_____X_____

4. Mark toward which hand the top of the writing paper is turned when the subject writes with the writing hand.

a. right_____ b. left_____ c. either_____ d. does not turn_____

5. Is the writing hand inverted (bent, hooked) when writing? a. yes____ b.no_____

6. Is the pencil place between the thumb and index finger and resting upon the middle finger when writing? a. yes____ b.no_____

7. Ask "is your pencil controlled from (find the spot where pressure is felt most) and then check off one) : a. the top of the pencil____ b. the bottom of the pencil____ c. other_____

8. When writing, is the hand resting on its side on the paper? a. yes____ b.no_____

9. Do you write and throw with the same hand? a. yes____ b.no_____

10. Trace your name with the left index finger and then the right index finger. Which feels the shapes best?

a. Left feels the formation of the symbols _____ b. Right feels the formation of the symbols_____ c. Both index fingers feel the sensation of the symbols equally._____

III Bimanual Rotation Activities

Bi-manually working counterclockwise when working with two hands together to rotate an object

Directions to open the small bottle with a screw on top provided.

First: Open the bottle and mark the first method used described below.

Next: watch the demonstration and try each of the other methods.

Also: mark any all other methods that are both comfortable and feel familiar.

1. ____ Holds with the right hand and unscrews the cap with the left hand
2. ____ Holds with the top hand and unscrews from the bottom.
3. ____ If the lid is unscrewed by using a bottom hand; this is the: (mark one answer below)
a. right hand ____ b. left hand ____ c. either hand ____
4. ____ Holds the bottle with the left hand and unscrews the top with the right hand
5. ____ Uses both hands together to turn the bottle and the lid
6. ____ If both hands are used together: mark which hand is on top. (mark one answer below).
a. right hand ____ b. left hand ____ c. either hand ____
7. ____ If both hands are used at different times while opening the bottle, "uses a "pattern",
(mark which hand is on top)
a. right hand ____ b. left hand ____ c. either hand ____

IV Large Rotation Movement

A. One arm rotation

1. Rubbing in a circle on a table top with your right hand would you prefer to move your hand:
a. mostly clockwise (right) ____ b. mostly counterclockwise (left) ____ c. no preference ____
2. Rubbing in a circle on a table top with your left hand would you prefer to move your hand:
a. mostly clockwise (right) ____ b. mostly counterclockwise (left) ____ c. no preference ____

B. Making Vertical Circles with Two Arms

1. The right hand is going: a. clockwise ____ b. counterclockwise ____
c. no preference ____
2. The left hand is going a. clockwise ____ b. counterclockwise ____
c. no preference ____
3. This activity difficult to do? a. yes ____ b. no ____

C. Body Twisting Rotating the hips with both feet on the floor direction preferred

1. a. clockwise ____ b. counterclockwise ____ c. no preference ____
2. This activity is difficult to do? a. yes ____ b. no ____

V Identifying Body Positions and Directional Perceptions

Check off all of the answers that best describe an arm or a hand position or sensation.

- A. Standing up straight with both arms relaxed and hanging by the sides.
Stiffen the arms concentrating on extending the fore arms from the elbow.

1. Does the right fore arm and elbow rotate with turning the of the hand ?
a. yes_____ b. no_____

2. Does the left fore arm and elbow rotate with the turning of the hand?
a. yes_____ b. no_____

3. If both fore arms rotate with the hands turning, are they alike or different?
a. right arm is turned more____ b. left arm is turned more____ c. identical_____

4. Can the right fore arm and elbow rotate without the turning of the hand ?
a. yes_____ b. no_____
5. Can the left fore arm and elbow rotate without the turning of the hand?
a. yes_____ b. no_____

6. If both fore arms rotate without the hands turning, are they alike or different?
a. right arm is turned more____ b. left arm is turned more____ c. identical_____

B. Perception of Arm, Hand and finger positions. Arms are stretched out from the elbows to the hands and rested palms down on a table.

Concentrate on the feel of both arms and hands with your eyes closed.

Do the arms feel:

1. - as if they are both facing downward?
a. yes_____ b. no_____

2. - as if they could both feel facing upward?
a. yes_____ b. no_____

3. - Can one arm can feel like it is facing downward and the other can feel like it is facing upward?
a. right arm is facing up_____ b. left arm is facing up_____

C. Do the hands feel:

4. - as if they are both facing downward?
a. yes_____ b. no_____

5. - as if they could both feel facing upward?
a. yes_____ b. no_____

6. - Can one hand can feel like it is facing downward and the other can feel like it is facing upward?
a. right hand is facing upward_____ b. left hand is facing upward_____