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# A critical comparison of optometric findings of identical twins as a means of determining their cylindrical lens needs

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**Abstract**

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Thesis

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A CRITICAL COMPARISON OF OPTOMETRIC FINDINGS OF  
IDENTICAL TWINS AS A MEANS OF DETERMINING  
THEIR CYLINDRICAL LENS NEEDS

BY

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A THESIS PRESENTED TO THE FACULTY  
OF THE COLLEGE OF OPTOMETRY  
PACIFIC UNIVERSITY

SUBMITTED IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE DEGREE,  
DOCTOR OF OPTOMETRY

A CRITICAL COMPARISON OF OPTOMETRIC FINDINGS OF  
IDENTICAL TWINS AS A MEANS OF DETERMINING  
THEIR CYLINDRICAL LENS NEEDS

CASE HISTORY:

Date: January 8, 1952

PATIENTS:

B. T. and S. T., females, age ten years, Newberg,  
Oregon.

COMPLAINT:

Original referral was made by their school teacher in a letter to this clinic stating that both girls read with their books held too close to their faces. They were not doing the kind of work in school that the teacher felt that they should be doing for girls their age. Both children complained of headaches. They are willing workers but their grades were not satisfactory according to their teacher. Neither twin had had a previous visual examination.

B. reported that she has trouble reading the blackboard, sometimes seeing two blackboards. Her eyes get quite tired after reading for a short time. Childhood diseases: mumps. The mother stated that the child was believed to have had a slight case of rheumatic fever at one time. The mother also reported that she frequently

transposes numbers when copying them.

S. reported that her eyes tire and ache after about one half hour of reading. She also was reported to be skipping and reversing words and numbers. She enjoys reading and claims that she would read more if her eyes did not get so tired. Childhood diseases: mumps and the measles.

#### PRELIMINARY FINDINGS

EXTERNAL EXAMINATION: (These are O.U. findings unless

noted as being otherwise.)

Position	Case (B) Eyes are parallel	Case (S) Eyes are parallel
Cilia & Palpebral	Straight & clear	Straight & clear
Lid Margins & Caruncle	Clear	Clear
Conjunctiva & Puncta	Clear & open	Clear & open
Sclera	Free of injection	Free of injection
Cornea	Clear	Clear
Ant. Chambers	Clear, adequate depth	Clear, adequate depth
Irides	Clear & regular	Clear & regular
Crystalline lens	No opacities	No opacities
Lacrimal drainage	Open	Open
Tension	Normal to touch	Normal to touch
Pupillary Reactions		
Direct	Present	Present
Consensual	Present	Present
Near point	Present but slow	Present

	Case (B)	Case (S)
Speed	D. & C. rapid	Rapid
Size	About 4 mm.	5 mm. to 2 mm.
Stay Contracted	No	No

## INTERNAL EXAMINATION:

Cornea	No opacities	No opacities
Ant. Chamber	Clear, depth adequate	Clear, depth adequate
Irides	Clear	Clear
Crystalline lens	No opacities	No opacities
Vitreous	Clear & no floaters	Clear & no floaters
Fundus color	Reddish-orange	Reddish-orange
Disc Margin	O.D. not too definite O.S. more sharply de- fined than O.D.	Distinct with temporal choroidal ring
Physiologic cupping	O.D. 1.00 D. O.S. No cupping	2.00 D
Vessel ratio	3/2	3/2

## OPTOMETRIC FINDINGS:

See Tables I and II.

## VISUAL SKILLS:

See Table III. (Case B) The cover test showed no deviations. Rotations were performed with great difficulty in all quadrants. She had great difficulty in following the target. The near point of binocularity was at 2 inches with doubling reported. This test was conducted twice: on the first attempt the left eye deviated out first while on the second attempt the right eye was first to deviate. Donders' Amplitude was: O.D.  $2\frac{1}{2}''$ , O.S.  $2\frac{1}{2}''$ , O.U.  $3\frac{1}{2}''$ . Fixations

— were good to the left while on the right side she had trouble maintaining fixation.

(Case S) No deviations revealed by cover test.

Monocular and binocular rotations were very good in all quadrants. Near point of binocularity was at 4 inches with O.D. turning out with no doubling reported. Donder's Amplitude was: O.D. 5", O.S.  $4\frac{1}{2}$ ", O.U. 4".

DIAGNOSIS:

Because of the similarity of the retinoscopic findings in both cases (near plano spheres), we were lead to believe that the major portion of the problem involved the cylindrical component of these corrections. However, despite the rather striking similarity in values of the cylinder as found in #2, #4, #5, and #7 in both cases, we found that application of the full cylinder as determined subjectively did very little to improve the visual acuity in the refracting room or in the skills situation. It was this factor that gave us great concern as to whether or not the full cylinder should be supplied.

In the case of B. the clock dial cylinder for O. D. chased all the way from  $-1.25 \times 180$  to no cylinder at all, while O.S. showed no cylinder on the clock dial. The first day's testing by the J.C.C. gave a  $-.50 \times 15$  cylinder for O.D. and a  $-.50 \times 150$  cylinder for O.S. The cylinder prescribed was that which was determined by the J.C.C. on the second day of testing. (Cylinder of #7 and #7A in Table I).



- In the case of S. the clock dial cylinder resulted in a  $-1.00 \times 10$  cylinder for O.D. and a  $-.75 \times 170$  cylinder for O.S. The cylinder on both O.D. and O.S. did very little to improve acuity at either far or near. Consequently, careful consideration had to be given in determining the amount of cylinder to be prescribed. The clock dial, J.C.C., #2, #4, #5 and #7 all show the presence of considerable cylinder.

Thus it would appear from the examination of the two sets of findings that some mutual solution might be advantageous in the determination of the final Rx. Despite tests indicating that the tentative lenses (in trial frames) gave no clue that they would do anything in the way of improving the visual acuity of either of these patients, we felt that due to the comparatively similar findings throughout each case we should prescribe the full cylinder that was determined by the #7 analytical finding in each of our respective cases regardless of the lack of improvement in the visual acuity at this time.

It was interesting to note some of the differences that were observed in the visual skills of B., both through plano and through the tentative Rx: far stereopsis was lower through the tentative Rx (as compared to plano), far point visual discrimination was slightly increased in O.D. and reduced in O.S., near stereopsis was significantly increased through the tentative Rx, but near-point visual discrimination

showed no improvement whatsoever.

PRESCRIBED TREATMENT:

(Case B.) The following lenses were prescribed for B. for fulltime wear: O.D.  $\nearrow$  .25 - 1.25 x 5  
O.S.  $\nearrow$  .50 - .50 x 155

The previous discussion of the cylindrical component of this prescription is justification for its being prescribed.

The small amount of plus and the .25D of anisometropia were prescribed because of the calculated lens requirements. The #7 and #7A findings show no anisometropia, however numerous other tests indicated that such a condition existed. The first day's testing resulted in a monocular #7 of O.D. = Plano, O.S. =  $\nearrow$  .25 D. The #4 and #5 scope findings indicated this difference, also. The plus found in #14A also justified its presence in the prescription. However, it need not be discussed as to whether or not it should have been prescribed, as the spherical equivalent of the two cylinders in themselves certainly creates an anisometric situation!

(Case S.) The following prescription would satisfy the analytical findings at both near and far:

O.D.  $\nearrow$  .50 - 1.00 x 10  
O.S.  $\nearrow$  .50 - .75 x 170

The clock dial cylinder showed O.U. = -.50 x 180. The cylinder determined by the retinoscope was O.D. - .75 x 15, O.S. - .50 x 180. The cylinder net as determined by Javal's modification of the gross ophthalmometer readings resulted in a cylinder for O.D. = - 2.25 x 10 and O.S. = - 2.50 x 180.

Thus it would appear that considerable variations were present.

The prognosis on this case was a subjective increase in cylinder, an increase in stereopsis and an increase in dot discrimination at far and near.

SUBSEQUENT PROGRESS REPORT: (Case B)

At this time the patient stated that she liked her glasses very much. No complaint of eyes hurting or headaches could be elicited from the patient.

The mother reported that B. was doing quite nicely in school (better grades) and that she had no complaints about her vision. No complaint of any kind could be elicited despite every effort to learn of any minute visual discomforts.

The analytical findings show very little change in the amount of acceptable plus. Subjectively, the cylinder powers and axes show some change but it is felt that her present Rx is adequate to the needs of the patient by reason of no complaint. The break and recovery findings have all dropped but now more nearly approximate the O.E.P. expecteds. The only significantly large change in the phorias is revealed in the shift of those in #20 and #21, but for the better.

It is of interest to note that all of the visual acuities (#4, #7, #7A, and entrance acuities) show no significant change since the original exam, however an important evaluation may be obtained by comparing the changes in the visual skills: far stereopsis has improved, far point

visual discrimination shows enhancement, near stereopsis is better and near point visual discrimination has improved. Thus it would seem that the skills battery may be a rather critical measuring device in this respect!!

(Case S.) The only statement from the patient was that she had found reading easier and more comfortable and her eyes didn't get as tired as before.

The mother of S. stated that she was making better marks in school than ever before.

The analytical findings showed slight improvement. A response to base out prism to blur at near and far was elicited which, previous to lens application, was absent. The acuity of the right eye increased from 20/25 to 20/20 through the same lens power. Although the gross plus at near decreased considerably, the x0 decreased correspondingly leaving nearly the same net plus. The ductions showed no significant change.

From the analytical findings alone there was not much indication of improvement. However, when comparison was made between the two skills findings, the change became quite obvious. The improvement in the far dot discrimination was one of equalization. The near dot discrimination went from 15 O.D. to 16 O.D. and from 11 O.S. to 16 O.S., which shows an increase in acuity as well as equalization. Stereopsis went from 0% to 40% at far and from 12% to 40% at near.

- No change was made in the lenses at this time although the O.S. could have been increased by a  $-.25$  D. cylinder.

S. was instructed to continue wearing her glasses at all times.

COMMENTS:

Probably the major contribution to optometric experience derived from these cases was to discover that the application of that amount of cylinder as determined subjectively was important to the visual performance of these patients, even though at the time of its application no change in the visual acuities could be noted. We do not wish to say that such is the case with all patients, but with the additional tests of an identical twin to aid in the evaluation of a cylindrical correction it was felt that the full cylinder should be supplied.

It is felt that these two girls are retarded in many ways: their apparent level of performance in school was lower than average, their lack of aggressiveness in the testing situation and their slowness to respond to all questions that were asked. It would appear that this may be in conjunction with or a result of the inability to get their visual acuities below a poor 20/20, even with lenses.

The progress reports bore out several interesting points that lead us to believe that the therapy supplied was not only giving considerable help to them but was also

beginning to bring about some changes in acuity - minute as they were. Although the analytical revealed little or no changes in acuity, the skills picture showed changes that were significant in that stereopsis and acuity showed improvement!!

The alleviation of the complaints of both patients is certainly not to be overlooked in the final analysis of their cases. Since we were planning to write up their cases, we deliberately questioned them for some type of complaint, but were finally convinced that no complaints were to be elicited.

A quotation from the teacher, who originally referred these children, will probably shed some light on the changes that she has observed in these children.

"I do think that both girls have been helped in various ways from their being fitted with glasses: no staying out of school with headaches. they take part in playground games and seem to be in a much happier frame of mind about school in general. Of course, both girls are very slow in oral reading, but they are doing much better work than they did in the fall in that respect. Their silent reading has come up from a 5 to a 3. Both of these girls have needed the glasses since they were in the third and fourth grades I am told by one of the other teachers. We do see a change, but in so short a time, it has been almost impossible for the girls to bring their grades up to where they should be yet. One of the girls took first prize in her 4-H sewing last week at their Achievement Night. Last year the leaders were unable to get them to even finish their projects. The fact that they are beginning to show interest in 4-H work and school work makes me think they are going to be helped by wearing the glasses, but both girls have a very low I.Q., and I don't think they will ever be able to make the advance-

ments and grades in school that children of their age should make. Now, they are very pleasant girls to work with, but when I first went out there to teach in the fall they weren't very cooperative."

SUMMARY:

By a cross comparison of findings taken on identical twins a fruitful decision was arrived at concerning the application of the full subjective cylinder in cases where it was found that no differences could be found in the visual performances of these patients through the tentative lenses. Because of the similarity of the cases it was decided that the full cylinder should be supplied in each instance.

The progress reports were sufficient testimony that the major complaints were satisfied by the corrections supplied.

The visual skills were also found to be a more refined means of measuring acuity changes than in the standard analytical manner. Sufficient changes were noted to justify a careful appraisal of their usefulness.

TABLE I  
SUMMARY OF Optometric Findings\*

Techniques or Skills	Dates Given		Case B	
	January 8, 1952		April 1, 1952	
	OS	OD	OS	OD
2 Ophthalmometer		-1.50x180		-1.75x180
Lateral phoria		-1.25x180		-1.25x180
13A at 16"		1 xo (plano)		ortho (4.50)
Lateral phoria				
13A at 16"		2 xo (plano)		3 xo (4.50)
4 "Static" retinoscopy	OD	Fl. -1.50x180	OD	Fl. -1.00x180
"Dynamic"	OS	4.25-1.00x150	OS	Fl. -1.25x150
5 retinoscopy at 20"	OD	4.75-1.50x180	OD	4.75-1.00x180
"Dynamic"	OS	4.00-1.00x150	OS	4.00-1.25x150
6 retinoscopy at 16"	OD	4.50-1.50x180	OD	4.50-1.00x180
Subjective to 20/20	OS	4.75-1.00x150	OS	4.67-1.25x150
7 at 13'	OD	4.50-1.25x5	OD	4.50-1.00x7
Subjective to best	OS	4.50-1.50x155	OS	4.75-1.25x160
7A V.A. at 13'	OD	4.75-1.25x5	OD	4.75-1.00x7
Lateral phoria at				
8 13' through No. 7		Ortho		1 xo
Base out to blur				
9 at 13' through No. 7		12		10
B.O. break and re-				
10 covery (13') No. 7		27/15		21/13
B.I. break and re-				
11 covery (13') No. 7		17/10		8/5
Vertical phoria at				
12 13' through No. 7		Ortho		Ortho
Vertical ductions				
12 at 13' through No. 7		6/7 S.D. 1/1 I.D.		8/7 S.D. 5/1 I.D.
Lateral phoria at				
13B 16" through No. 7		3 xo		3 xo
Dissociated cross	OD	4.25-1.75x5	OD	4.25-1.00x7
14A cylinder at 16"	OS	4.75-1.00x155	OS	4.50-1.75x160
Lateral phoria at				
15A 16" through all A		5 xo		6 xo
Binocular cross	OD	4.00-1.25x5	OD	4.75-1.00x7
15B cylinder at 16"	OS	4.25-1.00x155	OS	4.00-1.75x160
Lateral phoria at				
15B 16" through all B		5 xo		5 xo
B.O. blur out at				
16A 16" through No. 7		23		17
B.O. break and re-				
16B covery (16") No. 7		28/8		19/10
B.I. blur out at				
17A 16" through No. 7		28		12
B.I. break and re-				
17B covery (16") No. 7		30/8		17/10
Vertical phoria at				
17 16" through No. 7		Ortho		Ortho

A double ruling indicates a progress report was taken at this point. See Table I.

TABLE I  
SUMMARY OF Optometric Findings\*

Techniques or Skills	Dates Given		Case S	
	January 8, 1952		April 1, 1952	
	OS	OD	OS	OD
2 Ophthalmometer		-2.25x180		-2.50x180
Lateral phoria		-2.50x180		-2.50x180
13A at 16"		1 xo		2 xo (thru Fl.)
Lateral phoria				
13A at 16"		2 xo		2 xo (thru 4.50)
4 "Static" retinoscopy	OD	4.25-1.75x15	OD	Fl. -1.25x10
"Dynamic"	OS	4.75-1.00x180	OS	4.25-1.00x170
5 retinoscopy at 20"	OD	4.75-1.00x180	OD	4.75-1.00x180
"Dynamic"	OS	4.75-1.00x180	OS	4.75-1.00x180
6 retinoscopy at 16"	OD	4.50-1.00x180	OD	4.50-1.00x180
Subjective to 20/20	OS	4.50-1.00x180	OS	4.50-1.00x180
7 at 13'	OD	4.75-1.00x15	OD	4.75-1.00x170
Subjective to best	OS	4.75-1.00x180	OS	4.75-1.00x170
7A V.A. at 13'	OD	4.75-1.00x15	OD	4.75-1.00x170
Lateral phoria at				
8 13' through No. 7		Ortho		Ortho
Base out to blur				
9 at 13' through No. 7		12		9
B.O. break and re-				
10 covery (13') No. 7		27/15		11/7
B.I. break and re-				
11 covery (13') No. 7		17/10		9/4
Vertical phoria at				
12 13' through No. 7		Ortho		Ortho
Vertical ductions				
12 at 13' through No. 7		3/2 2/1		3/2 1/2
Lateral phoria at				
13B 16" through No. 7		4 xo		2 xo
Dissociated cross	OD	4.25-1.00x10	OD	4.75-1.00x10
14A cylinder at 16"	OS	4.25-1.75x170	OS	4.75-1.00x170
Lateral phoria at				
15A 16" through all A		10 xo		7 xo
Binocular cross	OD	4.00-1.00x10	OD	4.00-1.00x10
15B cylinder at 16"	OS	4.00-1.75x170	OS	4.00-1.00x170
Lateral phoria at				
15B 16" through all B		11 xo		4 xo
B.O. blur out at				
16A 16" through No. 7		thru 4.50		5
B.O. break and re-				
16B covery (16") No. 7		11/7		13/7
B.I. blur out at				
17A 16" through No. 7		7		8
B.I. break and re-				
17B covery (16") No. 7		19/8		16/10
Vertical phoria at				
17 16" through No. 7		Ortho		Ortho

A double ruling indicates a progress report was taken at this point. See Table I.



TABLE I Cont.  
SUMMARY OF Optometric Findings

Techniques or Skills	Dates Given	
	Case 3 January 8, 1952	April 1, 1952
Vertical motions		
18 at 16" through No. 7	6/2 S.S. 6/0 I.S.	7/2 S.S. 1/2 I.S.
Plus to blur at	OU -10.25	-11.50
19 13"	OU -9.75	-12.00
	OU -7.50	-12.25
Lateral phoria at		
20 16" through	1.00 (-1.25)	7.00 (-3.00)
Plus to blur out		
20 at 16"	-1.50	-3.50
Plus to blur out		
21 at 16"	+2.00	+1.25
21 Lateral phoria at	1.00 (+1.75)	7.00 (+1.25)
16" through		
* The numbers along are the same test designations for the designated tests as adopted by the Optometric Extension Program.		
** All far point is is now taken at 13 feet rather than 20 feet as this is the length of our refracting beam.		

A double ruling indicates a progress report was taken at this point. See Table I.

TABLE I Cont.  
SUMMARY OF Optometric Findings

Techniques or Skills	Dates Given	
	Case 3 January 8, 1952	April 1, 1952
Vertical motions		
18 at 16" through No. 7	6/2 S.S. 6/0 I.S.	7/2 S.S. 1/2 I.S.
Plus to blur at	OU -10.25	-11.50
19 13"	OU -9.75	-12.00
	OU -7.50	-12.25
Lateral phoria at		
20 16" through	1.00 (-1.25)	7.00 (-3.00)
Plus to blur out		
20 at 16"	-1.50	-3.50
Plus to blur out		
21 at 16"	+2.00	+1.25
21 Lateral phoria at	1.00 (+1.75)	7.00 (+1.25)
16" through		
* The numbers along are the same test designations for the designated tests as adopted by the Optometric Extension Program.		
** All far point is is now taken at 13 feet rather than 20 feet as this is the length of our refracting beam.		

A double ruling indicates a progress report was taken at this point. See Table I.

TABLE II  
SUMMARY OF Visual Acuity

Techniques or Skills	Dates Given			
	Case B			
Visual acuity on admission (No Rx)				
Far		Near		
OD 20/20		OD 20/30		
OS 20/25		OS 20/40		
OU 20/20		OU 20/30		
<hr/>				
	January 8, 1952		April 1, 1952	
No. 4 Acuity	OD 20/25 OS 20/25 OU 20/25		OD 20/25 OS 20/25 OU 20/25	
No. 7 Acuity	OD 20/20 OS 20/20 OU 20/20		OD 20/25 OS 20/25 OU 20/20	
No. 7A Acuity	OD 20/20 OS 20/20 OU 20/20		OD 20/20 OS 20/20 OU 20/20	
<hr/>				
Visual Acuity - Progress Report Entrance				
	Without Rx		With Rx	
Far		Near	Far	Near
OD 20/30		OD 20/25	OD 20/25	OD 20/20
OS 20/30		OS 20/20	OS 20/25	OS 20/20
OU 20/30		OU 20/20	OU 20/25	OU 20/20

A double ruling indicates a progress report was taken at this point. See Table I.

TABLE II  
SUMMARY OF Visual Acuity

Techniques or Skills	Dates Given			
	Case 3			
Visual acuity on admission				
Far		Near		
OD 20/25		OD 20/30		
OS 20/25		OS 20/30-2		
OU 20/25 -1		OU 20/30		
<hr/>				
No. 4 Acuity	OD 20/30 OS 20/25 OU 20/50		OD 20/30 OS 20/25 OU 20/25	
No. 7 Acuity	OD 20/25 OS 20/20 OU 20/20		OD 20/25 OS 20/20 OU 20/20	
No. 7A acuity	OD 20/25 OS 20/20 OU 20/20		OD 20/20 OS 20/20 OU 20/20-1	

A double ruling indicates a progress report was taken at this point. See Table I.

TABLE III  
SUMMARY OF Visual Skills

Techniques or Skills	Dates Given							
	Case B				Case S			
	1-9-52		4-1-52		1-8-52		4-1-52	
Accommodative Rock	OD	F	F	F		F		
Simultaneous recognition	CS	F	F	F		F		
Far-Point Binocularity		F	F	F		F		
Far-Point Steropsis		F	F	F		F		
Far-Point Ferical Suppression		F	F	F		F		
Far-Point Central Suppression		F	F	F		F		
Far-Point Visual Discrimination		F	F	F		F		
Hand and Eye Coordination		F	F	F		F		
Color Vision		F	F	F		F		
Far-Point Lateral Phoria		F	F	F		F		
Far-Point Vertical Phoria		F	F	F		F		
Near-Point Vertical Phoria		F	F	F		F		
Near-Point Binocularity		F	F	F		F		
Near-Point Steropsis		F	F	F		F		
Near-Point Lateral Phoria		F	F	F		F		
Near-Point Ferical Suppression		F	F	F		F		
Near-Point Central Suppression		F	F	F		F		
Near-Point Visual Discrimination		F	F	F		F		
Cover Test		F	F	F		F		
Rotations & Versions		F	F	F		F		
Saccadic Fixations		F	F	F		F		
Near-Point of Binocularity		F	F	F		F		

A double ruling indicates a progress report was taken at this point. See Table I.