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A second preliminary study of the "true macular vision test"

Roger T. Dowis
Pacific University

Stanley G. Huse
Pacific University

William E. Loveall
Pacific University

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Abstract

A comparison of the amount of anisometropia which was obtained by a septum technique at near utilizing alternate fixations, with the dissociated cross-cylinder test at near (#14A).

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DOCTOR OF OPTOMETRY

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Roger T. Dowis

Stanley G. Huse

Willis E. Loveall

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PURPOSE

A comparison of the amount of anisometropia which was obtained by a septum technique at near utilizing alternate fixations, with the dissociated cross-cylinder test at near (#14A).

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INTRODUCTION

This thesis represents a comparison of the findings obtained from two near point anisometropic tests. These tests are the Dissociated Cross-Cylinder test and the "True Macular Vision" (TMV) test for the near point. The former test is one of the basic procedures used in the analytical examination by optometrists today while the latter test has been introduced by Dr. Louis Jaques for the express purpose of providing an easily applied and simple test which would have the "use of both monocular fields as a binocular unit." This test is used by Dr. Jaques to reduce the "needless confusion in the philosopy of vision testing and prescribing."

In order to evaluate a test, we must: (1) determine if it is measuring the same function as the test with which it is being compared (2) determine its reliability and; (3) determine its validity.

This study was limited to the determination of any statistically significant difference between the anisometropic findings of the #14A test and the TMV test. Therefore the null hypothesis to be tested in this study is that no statistically significant difference exists between the anisometropic findings of the above two tests.

REVIEW OF LITERATURE

One of the best known septum techniques under binocular testing conditions is the Turville Infinity Balance Test.[1] The main idea of the test is that a flat septum with a width of several centimeters is used to occlude part of the chart from each eye. A black border around the chart is seen binocularly and serves to bring about peripheral fusion.

Morgan, Upon applying the Turville method to 215 patients, found that if the general criteria of acceptance of the prescription were used-namely, patient satisfaction maximum acuity under the circumstances, and repeatability of the findings-the prescriptions determined by the Turville method were highly satisfactory.

In comparing the prescriptions with those that would have been given using his "usual" procedure, Morgan noted that less than 10% departed significantly. A significant departure was assumed to be more than a $.50^D$ difference in the sphere, more than $.25^D$ difference in the cylinder, 10^o or more difference in the axis of the cylinder, and/or the incorporation of prism power in the prescription.

Brungardt[2] writes of a case in which the Turville subjective technique eliminated a pseudo-amblyopia elicited by normal testing. The patient accepted more plus before the amblyopic eye by this method as compared with the monocular method. The acuity increased from 20/60 to 20/25, and was thought to be due to the left eye monocularly over-accommodating with the correction in place resulting in a blur; but under binocular conditions, the right eye set the pace for accommodation and allowed fair acuity with the left eye. He also believes that his opinion can be supported by the over amount of plus found on static retinoscopy for the right eye. Here the left eye was fixating the target through at least 4.50^D blur.

Another method of binocular refraction, but without the septum, was shown by Dorland Smith.[3] This he called "cyclodamia", or "a method of control of the ciliary muscle tone while refracting." By placing $+1.50^D$ spheres over the retinoscopic or rough subjective refraction, acuity was equalized on 20/60 material. First one eye and then the other was covered briefly, and the acuity compared. (Plus sphere is reduced before the eye of lesser acuity.) When the acuity was equal at the binocular 20/60 level, the $+1.50^D$ spheres were removed alternately and the cylinder determined by the Jackson crossed cylinder.

Miles[4] believes that binocular refraction is not useful in the absence of fusion. He maintains that whatever method of refraction is used it is important never to blur the dominant eye. By blurring the dominant eye suppression of the eye is initiated, which leads to confusion and complaint. "In regard to balancing the sphere between nonpresbyopic eyes of average dominance and equal acuity, the binocular technique is valuable."

Another method of determining the binocular refractive error is called stigmatoscopy. Bannon et al [5] describes this technique as consisting of alternately focusing a monocularly seen point source of light by moving the position of the source, or by varying its optical distance with lenses, while the observer has binocular fixation on a central target. Ames and Gliddon, in 1928, built a modified stigmatoscopic instrument whereby the subject was placed in a forehead and chin rest mounted on a heavy base. The subject's pupils were aligned with the center of the lens cell placed 13.75 mm. in front of the corneal apices. In front of each eye was placed a semi-reflective mirror inclined 45° about a vertical axis. The mirrors were partially transparent, so that a target placed at 20 feet or at the near point could be seen. At each side, there was placed a point source of monochromatic light, 90° to the line of vision. The side arms had dioptric scales to indicate the optical distance of the light source from the eye. The light source could then be superimposed on the target in front of the observer. Ames and Gliddon noted that for a 20 foot viewing distance the normal setting was about .50 to .75 diopters on the myopic side for emmetropes or properly corrected ametropes. They concluded this was due to the spherical aberration of the eye. For the near target, there was no difference found as the focus of the point light source usually corresponded to the fixation distance in non-presbyopic patients. They maintained that in the accomodated eye the (positive) spherical aberration is greatly reduced or even over-corrected.

A recent study[6], completed in December of 1965, was undertaken in order to determine if there existed a statistically significant difference between the results obtained by the TMV Test for anisometropia and those obtained by the monocular negative relative accommodation tests (#21). The authors (Pugh and Kinsey) concluded that since there was a significant difference shown between the two tests, each test measured a different function. They also found that the TMV Test was a faster test than the #21 monocular and that " a .25 diopter change was more readily detected with the Jaques Technique.."

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PROCEDURE

A. Sixty prepresbyopic subjects were used in this study and they were selected randomly at the Pacific University Optometry Clinic. The only criterion used for selection was the possession of 20/20 visual acuity at 40 centimeters, O.D. and O.S. Each subject was placed behind the phoropter with his distance prescription in place.

B. The #14A test was given in the standard clinical manner. The illumination consisted of an overhead 60 watt lamp turned against the wall. Dissociating prism of four diopters was placed base down before the right eye and base up before the left eye. The lens banks were previously set at plus two diopter spheres O.U. and the Crossed Cylinder lenses were placed before the apertures with the red dots vertical. A cross grid target was set on the horizontal rod at a distance of sixteen inches before the subject. The instructions given the patient were: (1) How many charts do you see? (2) In the upper chart, which of the lines are darker, the vertical or the horizonta.? This last question was then repeated for the bottom chart. If the vertical lines were reported darker, plus was reduced in .25 diopter steps until a reversal was reported. If the horizontal lines were reported darker, plus was added until a reversal was obtained and then it was reduced to the next reversal.

C. The septum technique had the same illumination but did not have any dissociating prism. The phoropter was again set so that plus two diopters were present in the lens banks and the Crossed-Cylinder lenses were placed before the apertures as before. The target was a double cross grid chart which was placed at sixteen inches on the horizontal rod. The instructions given were the same as those of the previous test with the only difference being a substitution of the words "right" and "left" for "top" and "bottom".

D. The even-numbered subjects of Table I were given the TMV test first, while the odd-numbered subjects were given the #14A test first.

EXPERIMENTAL APPARATUS

Both tests were given on the same Bausch and Lomb Greens' phoropter. The TMV test utilized a translucent white plastic septum seven inches in heighth and six inches in width. This septum was placed directly next to the phoropter head on the horizontal rod. The chart used was a double cross grid chart with the cross grids 3.6 inches apart (laterally).

The chart used for the other test was the standard horizontal-vertical cross grid chart.

INTERPRETATION OF DATA

In order to designate the direction of the anisometropia, the plus before the right eye was algebraically subtracted from the plus before the left eye.

Table II shows a comparative difference between the anisometropia of the #14A test and the TMV test. This was obtained by algebraically subtracting the anisometropic difference of the latter test from that of the former test.

The date were subjected to the chi-square test to determine if the differences obtained between the two tests were statistically significant.

TABLE I

RAW DATA

Subject #		#14A	TMV Test
1.	O.D.	+1.00	+1.00
	O.S.	+1.00	+1.25
2.	O.D.	+1.25	+1.50
	O.S.	+1.75	+1.75
3.	O.D.	pl	+0.50
	O.S.	pl	+0.50
4.	O.D.	+0.75	+0.50
	O.S.	+0.75	+0.50
5.	O.D.	+1.00	+0.75
	O.S.	+1.25	+1.25
6.	O.D.	+1.75	+2.00
	O.S.	+1.00	+1.00
7.	O.D.	+2.75	+2.25
	O.S.	+2.25	+2.00
8.	O.D.	+1.50	+1.00
	O.S.	+2.00	+1.25
9.	O.D.	-0.25	pl
	O.S.	-0.25	pl
10.	O.D.	+1.75	+1.25
	O.S.	+1.50	+0.75
11.	O.D.	+1.50	+1.50
	O.S.	+1.50	+1.75
12.	O.D.	+1.00	+1.50
	O.S.	+1.25	+1.50
13.	O.D.	+1.75	+1.75
	O.S.	+1.00	+1.25
14.	O.D.	+1.50	+1.50
	O.S.	+1.75	+1.75
16.	O.D.	+0.75	+1.25
	O.S.	+0.50	+1.00
17.	O.D.	+0.75	+1.75
	O.S.	+0.75	+1.50
18.	O.D.	+1.00	+1.00
	O.S.	+1.00	+1.00

TABLE I (cont.)

Subject #		#14A	TMV Test
19.	O.D.	+0.75	+1.50
	O.S.	pl	+1.25
20.	O.D.	pl	+0.75
	O.S.	pl	+0.25
21.	O.D.	+2.50	+2.25
	O.S.	+2.25	+2.25
22.	O.D.	+2.75	+2.50
	O.S.	+2.75	+2.75
23.	O.D.	+3.25	+3.25
	O.S.	+3.00	+3.25
24.	O.D.	+0.75	+1.00
	O.S.	+2.25	+2.00
25.	O.D.	+2.00	+2.25
	O.S.	+2.25	+2.50
26.	O.D.	+1.75	+1.75
	O.S.	+1.50	+1.75
27.	O.D.	+1.25	+1.75
	O.S.	+1.50	+1.75
28.	O.D.	+0.50	+0.75
	O.S.	+0.50	+0.50
29.	O.D.	+1.50	+1.00
	O.S.	+1.25	+1.00
30.	O.D.	+1.75	+1.50
	O.S.	+1.75	+2.25
31.	O.D.	pl	+0.75
	O.S.	pl	+0.75
32.	O.D.	+1.50	+1.50
	O.S.	+1.50	+1.50
33.	O.D.	+0.25	+0.75
	O.S.	+0.50	+0.75
34.	O.D.	+0.50	+0.50
	O.S.	+0.75	+0.75
35.	O.D.	-0.75	+0.25
	O.S.	-0.50	-0.25

TABLE I (cont.)

Subject #		#14A	TMV Test
36.	O.D.	+0.50	+0.50
	O.S.	pl	+0.25
37.	O.D.	+1.25	+0.25
	O.S.	+1.75	+1.00
38.	O.D.	pl	+0.75
	O.S.	pl	+0.50
39.	O.D.	+0.75	+1.00
	O.S.	+0.75	+1.00
40.	O.D.	+1.25	+1.50
	O.S.	+1.25	+1.75
41.	O.D.	+1.50	+2.00
	O.S.	+2.00	+1.75
42.	O.D.	+1.50	+0.75
	O.S.	+1.50	+0.75
43.	O.D.	+1.75	+1.50
	O.S.	+1.75	+1.50
44.	O.D.	+2.25	+2.25
	O.S.	+2.25	+2.00
45.	O.D.	+1.00	+0.75
	O.S.	+1.00	+.075
46.	O.D.	+2.00	+2.00
	O.S.	+2.25	+2.00
47.	O.D.	+2.75	+2.25
	O.S.	+3.00	+2.50
48.	O.D.	+2.00	+2.00
	O.S.	+2.00	+2.25
49.	O.D.	+0.25	+1.00
	O.S.	+0.75	+1.00
50.	O.D.	+1.75	+1.75
	O.S.	+1.75	+1.75
51.	O.D.	+0.75	+0.75
	O.S.	+0.75	+0.50
52.	O.D.	+1.75	+1.75
	O.S.	+1.50	+1.75

TABLE I (cont.)

Subject #		#14A	TMV Test
54.	O.D.	+1.25	+1.75
	O.S.	+1.50	+1.75
55.	O.D.	+0.75	+1.25
	O.S.	+0.25	+0.75
56.	O.D.	+1.75	+2.50
	O.S.	+1.50	+2.00
57.	O.D.	+2.50	+2.25
	O.S.	+2.25	+2.00
58.	O.D.	+2.25	+2.50
	O.S.	+2.25	+2.50
59.	O.D.	+2.00	+2.00
	O.S.	+2.25	+2.00
60.	O.D.	+2.25	+2.00
	O.S.	+2.25	+2.00

TABLE II

Subject #	#14A Aniso. Comparison	TMV Test Aniso Comparison	Difference
1.	0	+0.25	-0.25
2.	+0.50	=0.25	=0.25
3.	0	0	0
4.	0	0	0
5.	+0.25	+0.50	-0.25
6.	-0.75	-1.00	+0.25
7.	-0.50	-0.25	-0.25
8.	+0.50	+0.25	+0.25
9.	0	0	0
10.	-0.25	-0.50	+0.25
11.	0	+0.25	-0.25
12.	+0.25	0	+0.25
13.	-0.75	-0.50	-0.25
14.	+0.25	+0.25	0
16.	-0.25	-0.25	0
17.	0	-0.25	+0.25
18.	0	0	0
19.	-.075	-0.25	-0.50
20.	0	-0.50	+0.50
21.	-0.25	0	-0.25
22.	0	+0.25	-0.25
23.	-0.25	0	-0.25
24.	+1.50	+1.00	+0.50
25.	+0.25	+0.25	0
26.	-0.25	0	-0.25
27.	+0.25	0	+0.25

TABLE II

Subject	#14A Aniso. Comparison	TMV Test Aniso. Comparison	Difference
28.	0	-0.25	+0.25
29.	-0.25	0	-0.25
30.	0	+0.75	-0.75
31.	0	0	0
32.	0	0	0
33.	+0.25	0	+0.25
34.	+0.25	+0.25	0
35.	+0.25	-0.50	+0.75
36.	-0.50	-0.25	-0.25
37.	+0.50	+0.75	-0.25
38.	0	-0.25	+0.25
39.	0	0	0
40.	0	+0.25	-0.25
41.	+0.50	-0.25	+0.75
42.	0	0	0
43.	0	0	0
44.	0	-0.25	+0.25
45.	0	0	0
46.	+0.25	0	+0.25
47.	+0.25	+0.25	0
48.	0	+0.25	-0.25
49.	+0.50	0	+0.50
50.	0	0	0
51.	0	-0.25	+0.25
52.	-0.25	0	-0.25

TABLE II (cont.)

Subject	#14A Aniso. Comparison	TMV Test Aniso. Comparison	Difference
54.	+0.25	0	+0.25
55.	-0.50	-0.50	0
56.	-0.25	-0.50	+0.25
57.	-0.25	-0.25	0
58.	0	0	0
59.	+0.25	0	+0.25
60.	0	0	0

TABLE III

CHI-SQUARE TEST

JAQUES TEST

		(-)	(0)	(+)	
		(1)	(2)	(3)	
	(+)	2	7	9	18
		(4)	(5)	(6)	
#14A	(0)	6	13	6	25
		(7)	(8)	(9)	
	(-)	10	5	0	15
		18	25	15	

Expecteds: $E_{cr} = \frac{(n_c)(n_r)}{N}$

E_{cr} = expectancy in a box located in a specific column and row
n_c = totals of the columns
n_r = totals of the rows
N = total number of cases

(1) $\frac{18 \times 18}{58} = 5.58$

(2) $\frac{25 \times 18}{58} = 7.78$

(3) $\frac{15 \times 18}{58} = 4.66$

(4) $\frac{18 \times 25}{58} = 7.78$

(5) $\frac{25 \times 25}{58} = 10.78$

(6) $\frac{15 \times 25}{58} = 6.47$

(7) $\frac{18 \times 15}{58}$ = 4.66

(8) $\frac{25 \times 15}{58}$ = 6.47

(9) $\frac{15 \times 15}{58}$ = 3.88

CHI VALUES

$$X^2 = \sum \frac{(E_{cr} - \text{actual finding})^2}{E_{er}}$$

(1)	$\frac{(3.38)^2}{5.58}$	=	2.040
(2)	$\frac{(.78)^2}{7.78}$	=	0.078
(3)	$\frac{(4.34)^2}{4.66}$	=	4.020
(4)	$\frac{(1.78)^2}{7.78}$	=	0.407
(5)	$\frac{(2.22)^2}{10.78}$	=	0.459
(6)	$\frac{(.47)^2}{6.47}$	=	0.034
(7)	$\frac{(5.34)^2}{4.66}$	=	6.110
(8)	$\frac{(1.47)^2}{6.47}$	=	0.334
(9)	$\frac{(3.88)^2}{3.88}$	=	3.880
	Total	=	17.362

degrees of freedom = (c-1)(r-1) = 4

c = no. of columns
r = no. of rows

5% level = 9.488
1% level = 13.277

DISCUSSION

With reference to column 3 of Table II, it is shown that 65.6% of the subjects manifested a different anisometropia for the TMV test than for the #14A test. Of these cases showing disagreement, twentym or 52.6% showed less anisometropia on the TMV test and eighteen, or 47.4% showed greater anisometropia.

The difference in anisometropia obtained between the two tests was subjected to the chi-square test and found to be significant to the 1% level of confidence. Therefore, the TMV and the #14A tests are not testing the same function, and should not be substituted for one another.

The majority of the subjects reported that discrimination was easier on the TMV test than on the #14A test.

The authors are in agreement as we observed the time of response to be generally shorter for the former test. This difference in time might be the result of the "normal" use of both monocular fields as a binocular unit (although such a conclusion is merely a representation of the authors' viewpoints).

CONCLUSION

This preliminary study of the TMV test compared to the #14A test found that the difference in amount of anisometropia obtained was statistically significant.

Since the null hypothesis was not upheld, we conclude that two different functions were being tested, assuming comparable reliabilities of the two tests.

A definite conclusion regarding the prescriptible superiority of the TMV test for anisometropia over that of the #14A test cannot be made until (1) a comparative reliability study of the two tests is made and (2)a comparative validity study of both tests is carried out.

SUMMARY

In summarizing we have found that:

(1) There is a statistically significant difference between the amounts of anisometropia as determined by the TMV test and the #14A test, and have therefore concluded that;

(2) the two tests are testing different functions;

(3) faster discrimination was made with the TMV test than with the #14A test.