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Gordon D. Moore
Pacific University

Douglas Quan
Pacific University

Charles D. Zawel
Pacific University

Recommended Citation

Moore, Gordon D.; Quan, Douglas; and Zawel, Charles D., "A study of certain accommodative findings under constant illumination with two different wavelengths of light" (1958). *College of Optometry*. 204. <https://commons.pacificu.edu/opt/204>

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Abstract

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Degree Type

Thesis

Degree Name

Master of Science in Vision Science

Committee Chair

Subject Categories

Optometry

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A STUDY OF CERTAIN ACCOMMODATIVE FINDINGS UNDER CONSTANT
ILLUMINATION WITH TWO DIFFERENT WAVELENGTHS OF LIGHT.

A Thesis
Presented to the Faculty of the College
of Optometry Pacific University

In Partial Fulfillment
of The Requirements For The Degree
Doctor of Optometry

By: Gordon D. Moore
Douglas Quan
Charles D. Zavel

May 19, 1958

INTRODUCTION

The purpose of this thesis is to study the effects on certain accommodative findings under two different wavelengths of light (*see below) while maintaining a constant intensity of illumination ($\frac{1}{3}$ to 1 footcandle) at the eye.

The study was conducted at a distance of 16" and 20 feet by varying convergence with B.I. and B.O. prism.

- *1. Blue-green filter has a wavelength of light between 420 to 580 millimicrons, with a maximum at 500 millimicrons.
2. The red filter has a wavelength of light greater than 590 millimicrons.

EQUIPMENT UTILIZED

1. B. & L. Phoropter.
2. Red-free green and green-free red filters.
3. Standard light bulbs -- 1-40 watt
1-75 watt
4. Reduced Snellen cards.
5. Meter stick.
6. Light meter.
7. Record sheets.

PROCEDURE

The patient was seated in a normal examining position in the refracting chair, as close to the phoropter as possible, to avoid stray light at the eye. The phoropter was set for the patient's near P.D.

The light source was direct illumination 12" from the reduced Snellen cards at the 16" plane. A 40 watt standard light bulb was used for white light and a 75 watt standard light bulb was used for red-free green and green-free red. No overhead or room illumination was used.

Sufficient sphere power was put into the phoropter when necessary so that the patient could read a 20/20 line of letters on a reduced Snellen card at 16". All procedures followed were precisely the same for all wavelengths of light.

A monocular #21 (plus lens to blur out) finding was taken to establish a fog condition for the near cylinder finding which followed. The targets for the near cylinder findings were a standard set of horizontal-vertical lines and a standard set of oblique lines set at 45° - 135°.

The horizontal-vertical lines were presented first and if there was any inequality observed, sufficient minus cylinder was added to cause a reversal. The axis of the cylinder was determined by "rocking" the cylinder axis in the phoropter and using the oblique line target. The power of the cylinder was refined by again presenting the horizontal-vertical line target to the patient in order to arrive at equality of the two sets of lines. This determined cylinder was used throughout the sequence of tests for each wavelength of light.

A #14A (monocular cross-cylinder equality) finding was measured. This #14A anisometropia was used throughout the sequence.

The patient was asked to read the 20/20 line of letters on the reduced Snellen card, and a #21 (binocular plus to blur out) finding was taken.

To arrive at an index of the patient's subjective refractive condition, the following two tests were used:

- (1) #21 through 16 p.d. B.I.
- (2) #14B through 16 p.d. B.I.

The index used was determined by subtracting 2.75D from (1) and 1.50D from (2) and taking an average of these two values. This averaged value was used as the control for the remaining tests in the sequence.

A #14B and then a #14B with 10 p.d. B.O. were then taken.

The following phoria measurements were taken, coming from B.I. towards B.O. and coming from B.O. towards B.I. The average of these two measurements was recorded.

- (1) Control index -1.50D phoria
- (2) " " -0.50D phoria
- (3) " " +0.50D phoria

The following duction findings were taken through the control index:

- (1) 16A
- (2) 16B
- (3) 17A
- (4) 17B

Patients were a selected group of young adults, ages 19 to 26 (80% male vs. 20% female) and free from existing substantial anisometropia and vertical disfunction.

The technique of the #14B was to come down from plus toward minus. If there was no reversal point, the choice was made in favor of the horizontal lines.

Three sittings per patient were required so that the patient would be fresh for each separate sequence of tests.

CALCULATIONS

An average #7 for white light for each patient was arrived at by taking the spherical equivalent of the cylinder and adding this value to the sphere power of the control index.

The variation of each accommodative finding for each wavelength of light was determined from the control index average for white light.

The mean average of each accommodative finding was taken.

The total of the following findings were divided by 5 and compared to the cross-cylinder values for color:

- (1) #14 B
- (2) #14 B + #14 B with B.I.
- (3) #14 B + #14 B with B.O.
- (4) #14 B + #14 B

#14A

+2.00 |
 +1.87
 +1.75
 +1.62
 +1.50
 +1.37
 +1.25 | | | |
 +1.12
 +1.00 | | | |
 +0.87
 +0.75 | | | | | | |
 +0.62 |
 +0.50 |
 +0.37
 +0.25 | | | |
 +0.12
 Plano
 -0.12
 -0.25 |

$$\text{Total} = \frac{18.12}{23} = +0.78 \text{ mean}$$

Binoocular #21

+3.50 |
 +3.37
 +3.25 | |
 +3.12
 +3.00
 +2.87
 +2.75 | | | | |
 +2.62
 +2.50 | | | | | | | |
 +2.37
 +2.25 |
 +2.12
 +2.00 | | | | |
 +1.87
 +1.75 |

$$\text{Total} = \frac{57.75}{23} = +2.50 \text{ mean}$$

21 through 16th B.I.

+3.75 |
 +3.62
 +3.50
 +3.37
 +3.25
 +3.12
 +3.00 | | | | | | | | | |
 +2.87
 +2.75 | | | | | |
 +2.62
 +2.50 | | | |

$$\text{Total} = \frac{46.00}{23} = +2.87 \text{ Mean}$$

14B THRU 16^{BI}

+2.00 |
 +1.87 |
 +1.75 | | | |
 +1.62 |
 +1.50 | | | | | | | | | |
 +1.37 |
 +1.25 | | | | | | |
 TOTAL $\frac{34.25}{23} = +1.50$ MEAN

14B W/O PRISM

+1.50 | |
 +1.37 | |
 +1.25 | |
 +1.12 |
 +1.00 | | | | |
 +.87 |
 +.75 | | |
 +.62 | | |
 +.50 | | |
 +.37 | | |
 +.25 | | |
 +.12 | | |
 pl | | |
 -.12 |
 -.25 |
 -.37 |
 -.50 |

14B W/10^{BO}

+1.75 |
 +1.62 | |
 +1.50 | | |
 +1.37 | |
 +1.25 | |
 +1.12 | | |
 +1.00 | | |
 +.87 | | |
 +.75 | | |
 +.62 | | |
 +.50 | | |
 +.37 | | |
 +.25 | | |
 +.12 | | |
 pl | | |
 -.12 | | | |
 -.25 | | | | |
 -.37 | | | |
 -.50 | | | |

TOTAL $\frac{10.37}{23} = +0.50$ MEAN

TOTAL $\frac{15.37}{23} = +0.62$

MONOC #21

+3.25 |
 +3.12 |
 +3.00 |
 +2.87 | |
 +2.75 | | | | | | | | | |
 +2.62 | |
 +2.50 | |
 +2.37 | | |
 +2.25 | | |
 +2.12 | | |
 +2.00 | | |
 +1.87 | | |
 +1.75 | | |
 +1.62 | | |
 +1.50 | | |

TOTAL $\frac{56.61}{23} = +2.46$ MEAN

17 Bime.

-1.00	1
-1.25	
-1.50	
-1.75	
-2.00	1
-2.25	
-2.50	1 1
-2.75	1
-3.00	
-3.25	
-3.50	1 1
-3.75	1 1 1
-4.00	1
-4.25	
-4.50	1 1 1
-4.75	
-5.00	1 1 1
-5.25	1
-5.50	1 1
-5.75	1
-6.00	
-6.25	
-6.50	1
-6.75	
-7.00	
-7.25	
-7.50	
-7.75	1

$$\text{total } \frac{97.75}{23} = \underline{-4.25} \text{ MEAN}$$

CONCLUSION

The findings under red show a shift in distribution toward more plus compared to white and the findings in blue showed a shift in distribution toward more minus compared to white.