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Abstract

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THE RELATIONSHIP OF THE NEAR PHORIA
IN THE READING LEVEL AND IN THE STANDARD
HORIZONTAL POSITION

BY

RAY ROY

DON CARKNER

MAY 28, 1965

Submitted in Partial Fulfillment
of the Requirement for the Degree:
Doctor of Optometry

Approved _____

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INTRODUCTION

The standard near phoria test is considered by many as a test of the fusional demand for near point tasks. Because most near point activity is done with the eyes in a depressed position, we attempted to determine to what extent the ^{vertical} horizontal near phoria was a valid test of the fusional demand existant under more normal near activites. After briefly consulting the papers in the literature concerned with ^{vertical} heterophorias, we found that many expressed, in a matter-of-fact way, that the only valid method of taking a near phoria test was in a normal reading position. ^{Scobee} Scobee states that it is important to test the near heterophoria in a position so that the eyes approximate the reading position.¹ Meredith Morgan mentions that convergence is facilitated when the gaze is directed to a depressed position. He calls this an increase in proximal convergence.² It has also been

¹Richard Scobee, The Oculorotary Muscles, Second Edition, (St. Louis: C. V. Mosby Co., 1952), page 500.

²Meredith W. Morgan, "Anomalies of the Visual Neuromuscular System of the Aging Patient and Their Correction," Vision of the Aging Patient, chapter 7, page 123.

stated by Krinsky that the near point of convergence was directly related to the "...uniform direction of gaze downwards and forwards corresponding to the natural direction of the eyes for this near distance..."³ He also says that the exophoria will be reduced when the gaze is downward, and the usual reading position causes a drop in the gaze of approximately 30°. ⁴ The reading level that was used in this investigation was determined by experimentation and was validated by Meredith Morgan in a paper titled "Accommodative Changes in Presbyopia and Their Correction." It states that the average level of most near point work is 40° to 60° below the horizontal and about one-half of this is due to head movement, the other part due to depression of gaze.⁵

Past investigations show that there is a drop in exophoria at the reading level. A reduction in exophoria was found in 1955 by Dramen, Berman, and Dickes in their fifth year thesis at Pacific University. A study was done in 1945 by Connolly and Koprowski. The procedure

³Emanuel Krinsky, The Management of Binocular Imbalance, (Philadelphia: Lea and Febiger, 1948), page 58.

⁴Ibid., page 101.

⁵Meredith W. Morgan, "Accommodative Changes in Prebyopia and Their Correction," Vision of the Aging Patient, chapter 6, page 111.

was very similar to this investigation. They undertook to determine the changes in the lateral phoria with vertical changes in fixation ranging from 30° above to 40° below the horizontal. The results showed that at a 25° depressed position less exophoria was measured as an average for all ages.⁶

The population sample of 40 subjects ranged in age from 14 to 76 years. There were 29 below the age of 40 and 13 above 40. All subjects were tested in the afternoons at the Pacific University Clinic.

⁶Paul Connolly and Aloysius Koprowski, "Changes of Lateral Phorias With Vertical Changes of Fixation," American Journal of Optometry and Archives of American Academy of Optometry 22: pages 399 - 405.

METHODS

The equipment used in this study was:

- A. One-half arc perimeter with a fixation distance of thirteen inches.
- B. 10^A B. D. dissociating square prism.
- C. Hand rotary prism.
- D. Standard trial lens kit.
- E. Two reduced Snellen cards, lines ranging from 20/20 to 20/100.

Following completion of the recording forms, the subject was instructed to place his chin in the modified chin rest position so that his nose was centered on the vertical bar of the perimeter in order that the subject not move his head. The subjects wore their habitual lenses used for near point work during the entire sequence. In those cases where the subjects wore a habitual bifocal addition plus spheres equal to the add were held before the subjects when they were directed to the primary horizontal target. These were removed when the subject was directed to the depressed position as the bifocal segment was being used. The 10^A B. D. dissociating prism was placed over the subject's left eye and the hand rotary

prism over the right eye at a distance of about 1.5 cm and the subject was told to report when the lower chart was directly over the upper chart while reading the lowest possible line in the upper chart. The phoria was measured from B. I. to alignment three successive times without allowing fusion. The total average time that a subject was dissociated was 10 seconds. The prisms were then removed and fusion was allowed for a period of 30 seconds before the subject was directed to the 25° depressed target and the same procedure was followed exactly. Following completion of the three successive measurements in the depressed position the entire sequence was run again following a 30 second fusion period. The room illumination was 21 foot candles.

RESULTS

Because of the possibility that different relationships may exist in the prebyope and non-prebyope, the sample was divided into these two categories. Discussion of the data will be handled in this manner also.

Non-Presbyope

Table I

Testing Position	Mean	Standard Deviation
First Horizontal	4.22 ^A	3.53
Second Horizontal	5.14 ^A	3.65
First Depressed	3.52 ^A	3.57
Second Depressed	3.85 ^A	3.50

From Table I, we see the mean difference between the horizontal phorias is .92^A, and that of the phorias in the depressed position is .33^A. From analysis of the "F" score, being 1.079 and 1.041 respectively, we found that the differences were not significant, even to the one per cent level. The average difference between the horizontal and depressed phorias was found to be 1.00^A. This difference was extremely constant, with a correlation coefficient of .960. This was also found to be a significant difference, with a "t" score for the correlated variables of 1.704.

This value indicates that five times out of 100 this would happen by chance.

Presbyope

Table II

Testing Position	Mean	Standard Deviation
First Horizontal	8.97 ^Δ	4.04
Second Horizontal	9.77 ^Δ	4.01
First Depressed	6.42 ^Δ	3.86
Second Depressed	7.06 ^Δ	3.65

From Table II, the mean difference between the two sets of horizontal phorias was .80^Δ, and the mean differences of the phorias in the 25° depressed position was .54^Δ. From the "F" score of 1.016 and 1.113, respectively, we found that these differences were not significant. The overall mean difference between the horizontal and depressed phorias was found to be 2.62^Δ. This difference was quite constant with a correlation coefficient of .927. Also it was found to be significant, with a "t" score for the two correlated variables of 3.574. This indicates that there is less than one time out of 200 this would happen by chance.

DISCUSSION

As can be seen from the previous section, the similarities in data and in statistical analysis are marked between the presbyopic and non-presbyopic groups. Both show a significant and relatively constant difference between the horizontal and 25° depressed phoria, with the magnitude of the difference being greater in the presbyope. Thus, as can be seen from Figure I, the data indicates that a constant value, and not a percentage of the phoria, of 1.0^Δ for the prepresbyope, and 2.62^Δ for the presbyope can be subtracted from the horizontal phoria, and the probability is high that this will predict the 25° depressed phoria.

It is also interesting to note that the overall average in the phorias at the two positions, for presbyopes and non-presbyopes taken together, is 1.50^Δ. Data in the paper by Connolly and Koprowski at Pennsylvania State College of Optometry also shows a 1.50^Δ drop in exophoria as a mean at the 25° depressed position.⁷

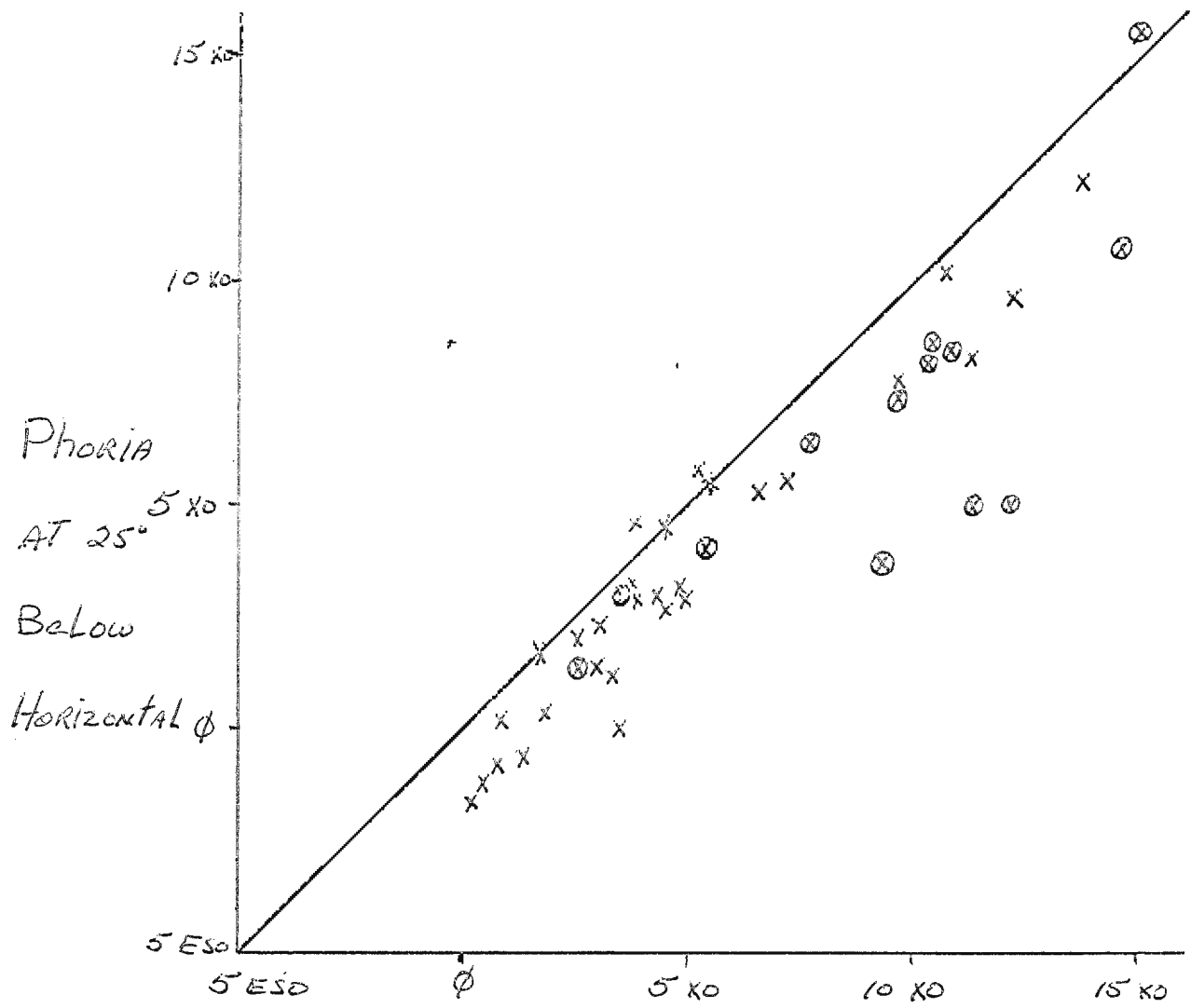
Concerning the importance of this difference in clinical use, it is felt that in most cases, the standard near phoria test with the appropriate constant subtracted

⁷Ibid., page 402.

is a valid test of the fusional demand at the reading position. But in a few cases the drop in exophoria was significant to the extent that we feel a test should be conducted at the reading position for a more valid clinical analysis.

Suggestions for Further Study

It is felt that an informative follow-up study could be made from this investigation. These writers would suggest a study of only presbyopes, with a large sample of the population. Two changes in controls are suggested--utilization of the presbyopic addition in both the horizontal and depressed positions, keeping the decentration constant. The second suggestion would be to eliminate the errors in the data induced by the lens power and vertex distance.



Phoria in Horizontal

Figure 1

- ⊗ - Presbyopes
- x - Prepresbyopes

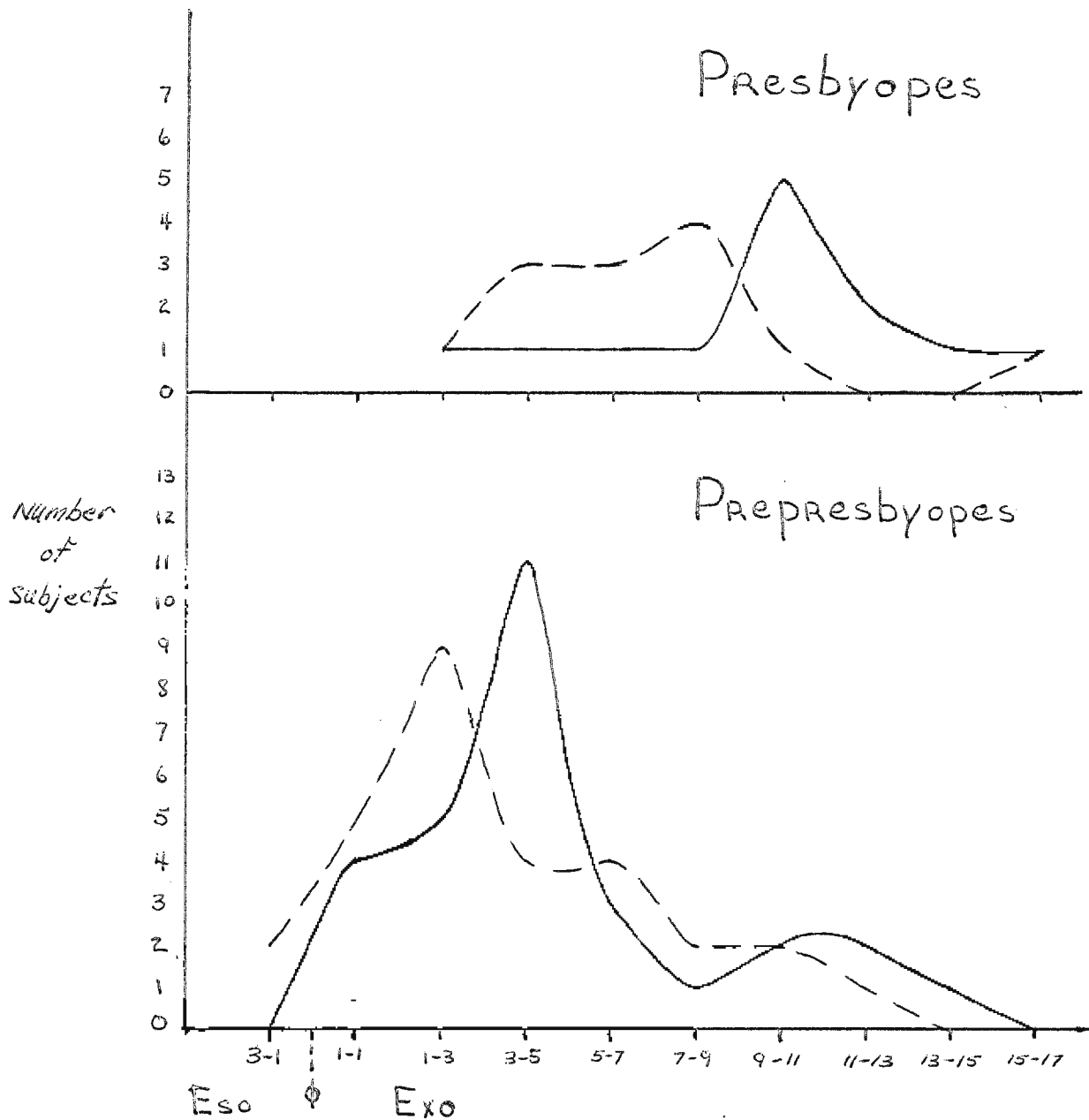


Figure 2. PHORIAS IN GROUPS OF TWO PRISM DIOPTERS

Distribution curve showing the MEAN phoria in the horizontal position (solid line) AND the MEAN phoria in the 25° depressed position (broken line).

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