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The phoric response in the nine cardinal fields of gaze

Ralph C. Berghuis
Pacific University

Jack E. Nelson
Pacific University

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The Phoric Response in the Nine Cardinal Fields of Gaze

A 5th Year Clinical 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
Ralph C. Berghuis
and
Jack E. Nelson

January 1958
Introduction

A continuation of the investigation of "The Phoric Response in the Nine Cardinal Fields of Gaze" presented to the faculty of the College of Optometry of Pacific University, January 1955 by Ward and Arnold and in June 1955 by Druman, Dickes and Berman.

PROBLEM:

To determine if there is any change in the lateral phoric response in the nine cardinal fields of gaze using the red-green scopes. This represents a change in technique from previous studies.

EQUIPMENT:

1. Hess Chart (white) designed for use at 1 meter distance (diagram #2).
2. Adjustable chin and forehead rest.

PROCEDURE:

Thirty subjects were chosen at random from the student body of the College of Optometry at Pacific University. These students ranged in age from 22 to 37 years of age. These were all normal clinical patients without abnormal visual uncorrected deficiencies.
Each subject was seated before the Hess Chart at a distance of 2 meters. The height of the chin rest and head rest could be so adjusted so that the subject's eyes were at the same height as the exact center of the Hess Chart and an imaginary perpendicular line from the Hess Chart would pass directly between the eyes of the subject. The subject was cautioned not to move their head while the tests were being taken. (See diagram #1)

The Jacques Scopes were placed on the table directly beneath the subject's chin and he was instructed to guide the right scope with his right hand which was the projector for the red light. The left scope was operated by the tester and this scope projected the green spot. The red-green goggles were placed before the subject's eyes so that the green lens was before the left eye and the red lens before the right eye. The red lens allowed the red spot to be seen with the right eye only and the green lens allowed the green spot to be seen by the left eye only. The tester placed the green spot on one of the nine cardinal positions and the subject was asked to cover this green spot with the red spot. (Refer to chart #1 for sequence of tests). The phoric measurement was then recorded. This was successively done until all nine positions were recorded with a repeat on the initial #1 position. These were done until using the same sequence with each subject. If the subject wore a lens prescription, the red-green goggles could be placed behind the spectacles without the frame being disturbed from the habitual position of adjustment. This was
done with the room in total darkness. The entire sequence took approximately 2 minutes after the subject was set in position and the room darkened.

RELIABILITY OF THE TESTING PROCEDURE:

The entire routine was performed upon two of the subjects at five different settings and the results were statistically determined for reliability of the testing responses. It was found that there is no significant difference at the 10% level. The t value was 4.81.

RESULTS:

The raw data and statistical work on the 30 subjects is on file in the Visual Training Laboratory at Pacific University.

Graph #1

The findings in each position of the 30 subjects. The initial phoric response was determined and the #1 position was graphed on the line with its value at the zero point on the graph. The phoric responses were then recorded successively with the esophoric responses in red and the exophoric responses in blue. By inspection, it can be seen that subjects #2, #3, #4, #6, #8, #10, #11, #12, #13, #14, #20, #22, #23, #28 and #29 went both eso and exo from the initial position #1. Also the balance, it will be noted, went either eso or exo, and this did not depend on the initial phoric response.
Table #1

This table shows the standard deviations of the ten responsive positions. By inspection they show a gradual increase from position #1 through #1A.

Graph #2

This graph shows the mean values of each position for all 30 subjects. Comparing this graph with the chart #2, it will be noticed that the positions at the extreme corners show a tendency to move more phorically and it can be also seen that these movements are more in eso. However, the return to position #1A shows a greater movement in esophoria than does the position last tested, and that one, a corner. Subtracting position #1A from #1 and dividing by 10 for the number of testing positions, shows a gradual change in concomitancy of .05 diopters for each test position. This, however, does not mean that the phorias tend to show a constant increase from #1 to #1A as a glance at chart #2 will show.

Graph #3

Distribution graphs show the phoric responses of positions #2 through #1A. These values were determined by attaching plus and minus values to the measured responses. The amount was determined by the plus or minus movements from position #1.

For example, if #1 was 3 eso and #2 was 2 eso, then the value given #2 was plus 1. If #3 was 1 eso, then the value given #3 was minus 1. These values were laid out in graph
form with each graph showing the incidence of responses of 30 patients in each position.

It will be noted that each position has the highest incidence of response on the zero point with the exception of positions #1, #5 and #9 and the #4 and #5 positions equaled at the zero point by only one other phoric response value. The ortho point on #9 is equaled by two others and excelled by only one other.

CONCLUSIONS:

From the limited data collected on this experiment, it can be assumed that there is a difference in the phoric pattern in the different positions of gaze. This does not show any particular tendency for the subjects to assume any particular pattern shift of prediction.

Also it shows that concomitant phoric responses are only a gross approximation, clinically it will vary.

It is known that patching an eye will show movements toward exophoria. The findings in this paper show a movement toward esophoria. However, this again cannot be predicted on a single patient basis. This is only a conclusion based on the mean of 30 subjects.

PROBLEMS THAT MAY BE CONSIDERED IN FUTURE TESTING OF PATIENTS WITH THIS EQUIPMENT:

1. Is the phoria relationship of patients with known binocular problems the same as found in this experiment?
2. Do the findings follow any particular pattern when the vertical findings are considered along with the lateral findings?

3. Would the findings show a particular pattern using control groups of all exophoric or esophoric patients as taken first with a rotary prism at the same distance using acuity letters on a dissociated phoria as determined in our clinic routine?

4. Would the findings show the same patterns using a control group first with rotary prisms at 2 meters and then red-green at 2 meters?

5. How would the findings differ using a control group before and after visual training?
<table>
<thead>
<tr>
<th>Position</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>2.16</td>
</tr>
<tr>
<td>#2</td>
<td>2.32</td>
</tr>
<tr>
<td>#3</td>
<td>3.12</td>
</tr>
<tr>
<td>#4</td>
<td>2.70</td>
</tr>
<tr>
<td>#5</td>
<td>2.60</td>
</tr>
<tr>
<td>#6</td>
<td>2.16</td>
</tr>
<tr>
<td>#7</td>
<td>2.59</td>
</tr>
<tr>
<td>#8</td>
<td>3.60</td>
</tr>
<tr>
<td>#9</td>
<td>4.15</td>
</tr>
<tr>
<td>#1A</td>
<td>3.35</td>
</tr>
</tbody>
</table>
Dimensions of Hess Chart

65 cm

46 cm

30 cm

4 cm

6 cm

10 cm

15 cm

7 cm

4.5 cm

2 cm

Square

Square
Diagram #3

Dioptic Values of Squares on Hess Chart of 2 Meters