How trustworthy are vertical phoria findings in the phoropter?

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Abstract
Vertical phorias detected in the phoropter using the Von Graefe technique are often regarded as artifactual, while vertical duction (vergence) findings are usually considered valid and reliable indicators of true vertical deviations. Data from twenty-two patient case records showing vertical phorias were used to determine the correlation between the vertical phorias and the midpoints of the opposing duction values. In general, the calculated correlation coefficients were significant, thereby supporting the results of earlier studies. Hence, for these twenty-two patients, the Von Graefe vertical phoria proved to agree fairly well with the vertical imbalance shown by the vertical vergences.

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HOW TRUSTWORTHY ARE VERTICAL PHORIA

FINDINGS IN THE PHOROPTER?

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Doctor of Optometry

by
Randall K. Nelson
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ABSTRACT

Vertical phorias detected in the phoropter using the Von Graefe technique are often regarded as artifactual, while vertical duction (vergence) findings are usually considered valid and reliable indicators of true vertical deviations. Data from twenty-two patient case records showing vertical phorias were used to determine the correlation between the vertical phorias and the midpoints of the opposing duction values. In general, the calculated correlation coefficients were significant, thereby supporting the results of earlier studies. Hence, for these twenty-two patients, the Von Graefe vertical phoria proved to agree fairly well with the vertical imbalance shown by the vertical vergences.
I. Introduction

The detection and measurement of vertical deviations deserves great attention from the eye care specialist because of its implication in visual discomfort and problems of correction. Since the amplitudes of vertical fusion tend to be limited, vertical imbalance is likely to cause symptoms. In most clinical settings, the vertical phoria and duction (vergence) findings taken through the phoropter using Risley prisms are used for initial determination of the presence of vertical imbalance. According to Borish (1975), the vertical ductions (vergences) are usually stable and equal in both directions when no true vertical discrepancy exists. If, on the other hand, a right hyperphoria exists, the right supraduction should exceed the right infraduction. The disparity between the opposing ductions tends to agree with the extent of the vertical deviation.

Morgan raised several important questions about testing for vertical imbalance. One question he raised was the problem of distinguishing between a true vertical malfunction and a finding that is an artifact of the test method. Some individuals show an apparent hyperphoria that seems to depend on the specific conditions of occlusion and dissociation used in the testing method. Therefore, artifactual data in phoropter vertical phoria
measurements may be related to the restricted fields and disrupted fusion. Perhaps other factors that are not well documented or recognized yet are involved in false vertical phoria findings. The vertical vergence findings, however, are considered to be relatively free of artifacts and indicative of the true state of vertical functioning.

One way to investigate this further is to determine if a significant correlation exists between the vertical phoria and the midpoint of the vertical vergences. A discrepancy in the opposing vergences is considered to indicate a true, or at least latent, imbalance. If the correlation proves to be insignificant, it might be concluded that vertical phoria findings taken through the phoropter are not very useful for establishing the presence of a true vertical deviation.

II. Method

Twenty-two patient records were selected from the clinical files of Pacific University College of Optometry using the following criteria: 1) age 20 to 40 years, 2) no ocular or systemic pathology, 3) normal binocular vision with equal corrected acuities of 20/20 or better at distance, 4) induced lateral heterophoria less than or equal to 4 prism diopters of esophoria or exophoria at distance, 5) normal accommodative amplitude based on Donders table,
and 6) a far vertical phoria of at least $\frac{1}{2}$ prism dioptr as determined by the usual Von Graefe technique\textsuperscript{8} using continuous presentation from both directions.

Only those records showing measurable phorias were accepted since the calculated correlation coefficient values must address the question mentioned earlier: If a vertical imbalance is detected in the refractor, is it real or induced by the testing conditions? The near vertical phoria and vergence findings were ignored because of possible interfering variables such as uncontrolled accommodation and uncorrected lateral phorias of high degree.\textsuperscript{9} Calculations of the Pearson product-moment correlation coefficients were made by pairing the vertical phoria values with the midpoints of the corresponding opposing vergence values. Correlation coefficients were determined for both break and recovery findings. The sign conventions used in the calculations are as follows:

- Right hyperphoria: +
- Left hyperphoria: -
- Right supravergence: +
- Left supravergence: -
## Data Summary

<table>
<thead>
<tr>
<th>Patient</th>
<th>vertical phoria (A)</th>
<th>vertical vergences (A)</th>
<th>break midpoints (A)</th>
<th>recovery midpoints (A)</th>
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<td>supra</td>
<td>infra</td>
<td>supra</td>
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<td>3/1</td>
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<tr>
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<td>R 6/2</td>
<td>1/-2</td>
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</table>
Calculation Results

1) Males, n = 9
   a) $r_B = +0.68$  $p < .05$
   b) $r_K = +0.80$  $p < .01$

2) Females, n = 13
   a) $r_B = +0.72$  $p < .01$
   b) $r_K = +0.46$  $p > .1$

3) Total, n = 22
   a) $r_B = +0.77$  $p < .01$
   b) $r_K = +0.59$  $p < .01$

where:

$r_B$ represents the correlation coefficient for the phorias paired with the midpoints of the vergence break values

$r_K$ represents the correlation coefficient for the phorias paired with the midpoints of the vergence recovery values

$p$ values from Fisher$^{10}$
III. Discussion

A. Significance of results

According to Spiegel, if the degree of uncertainty (p) is .01 or less, the results are highly significant; if (p) is between .01 and .05, the results are probably significant; and if (p) is greater than .05, the results are not significant.\(^{11}\) Hence the only correlation coefficient that is insignificant is \((r_R)\) for the female group. The remaining coefficients are fairly high—nearly +0.6 or greater—in addition to being probably or highly significant. This indicates that when a Von Graefe vertical phoria test detects \(\frac{1}{2}\) prism diopter or more, the midpoint of the opposing vertical vergences usually reflects the direction and magnitude of the phoria. In more general terms, there are two possibilities indicated by the results: 1) the vertical phorias detected with the Risley prisms are usually not artifactual, or 2) both the vertical phorias and vertical vergences are often simultaneously artifactual. Furthermore, it is not possible to rule out the existence of a vertical phoria when the opposing vergences are balanced.

B. Clinical implications

Even though the results discussed above are in accordance with those of earlier studies, it is probably best to continue following Morgan's warning that
all vertical phorias found in the phoropter are suspect. For the purpose of managing such patients successfully, various tests outside the phoropter should be performed in order to verify and quantify the deviation. These include the Turville Infinity Balance, the red lens cover test, and out-of-phoropter Maddox techniques. Morgan found that the Turville method was the best technique for assessing vertical imbalances.¹²

Prescribing vertical prisms for symptom alleviation is a matter of some disagreement with regard to when to prescribe and how much prism to use; the numerous considerations are beyond the scope of this study. Therefore, a separate reference list has been included for various views of the rationale and methods involved in managing vertical imbalances. Some clinicians have been attempting to use vision therapy techniques for increasing the vertical fusion ranges where they are insufficient to compensate for a vertical phoria. So far, no long-term studies have appeared documenting the effectiveness of such procedures.
NOTES


CLINICAL REFERENCES


5. Morgan (1954) as above.