A comparative investigation of phoropter refraction and trial frame refraction.

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Special Studies

A comparative investigation of phoropter refraction and trial frame refraction.

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Introduction

The phoropter is the standard instrument by which a spectacle prescription is often found. However, for those who are confined to either bed or wheelchair, an in-office visit is often out of the question. The most obvious alternative for these patients is a house call incorporating a trial frame refraction.

The trial frame refraction requires a few modifications of the standard phoropter refraction. It is the purpose of this paper to investigate any differences that may occur in a patient's final prescription due to these modifications.

Population

The population of subjects consists of 25 students (50 eyes) from Ferris State College.

Method

The test subjects first underwent trial frame refraction. Then at a later date the same subjects underwent phoropter refraction. The standard phoropter refraction was performed last so as not to bias the initial trial frame refraction. The two methods of refraction were completed in the following manner:

Trial Frame Refraction:

A. Subject's P.D. was placed into trial frame.
B. Under low illumination and with +1.50 diopter trial lenses in place before each eye, static retinoscopy was done with the Snellen 20/400 letter (illuminated with red and green) as a target.
C. With one eye occluded, the +1.50 diopter working lens used in retinoscopy was removed. The spherical component was refined using $\pm$0.25 diopter trial lenses.
D. The axis and power of any cylindrical component (found in retinoscopy) was refined using a +0.50 diopter handheld Jackson cross cylinder.
E. The spherical component was again refined in $\pm$0.25 diopter steps. The same procedure was then followed for the other eye.
F. With 6 prism diopters (base down) in front of the right eye, and 6 prism diopters (base up) in front of the left, a dissociated blurr balance was performed.
G. With both eyes viewing the distant Snellen chart, $\pm$0.25 diopter lenses were presented binocularly to obtain a binocular subjective.

Standard Phoropter Refraction:

A. Subject's P.D. was placed into phoropter.
B. Under low illumination, static retinoscopy was done with the 20/400 Snellen letter (illuminated with red and green) as a target.
C. With one eye occluded, the Jackson cross cylinder was placed before the open eye and the axis then cylinder refined in minus cylinder form.
D. The best monocular subjective was obtained by first fogging vision so that the Snellen 20/20 letters couldn't be read. The fog was then reduced by adding minus lenses in 0.25 diopter steps until the 20/20 line could first be read. Then no more than -0.50 diopter was given so the subject would not be over-minused.
E. The same procedure was then followed for the other eye.
F. With 6 prism diopters (base down) in front of the right eye, and 6 prism diopters in front of the left, a dissociated blurr balance was performed.
G. With both eyes viewing the distant Snellen chart, $\pm$0.25 diopter lenses were presented binocularly to obtain the binocular subjective.

Results

The data can be represented on a series of three graphs. (See Figures 1, 2, and 3.) Each graph represents a specific component of the final refractive correction: sphere, cylinder, and axis. The abscissa of each graph represents either the change in dioptic power of axis when changing from trial frame to phoropter refraction. The Y-axis of each graph represents the number of eyes, showing change. Changes noted between the two methods of refraction are shown in percentage form in Table 1.

Discussion

From inspection of the results, two points of interest merit further discussion: the first, that the greatest incidence of change occured in the sphere power; the second, that the most significant changes occured in the axis and cylinder power. For example, of the 52% who changed in the spherical component, 27% showed a change of 0.50 diopter or more. However, of the 44% who changed in the cylindrical component, 41% showed a change of 0.50 diopter or more. And, of the 40% who changed in the axis component, 45% showed a change of 9 degrees or more.

One discrepancy between the two refractive methods was in the method of refining the spherical component. This required holding loose trial lenses in front of one or both eyes in order to arrive at a spherical subjective endpoint. Unlike phoropter refraction, the vertex distance of the loose lenses varied due to the structure of the trial frame and the manner in which the lenses were presented. This could account for the higher incidence of change in the spherical component when changing from one method of refraction to the next. Trial lenses are presented in 0.25 diopter steps when refining the spherical component. It is interesting to note that of the 52% who showed a discrepancy in the spherical component, 73% of them did so by only 0.25 diopter. Trial frame refraction requires the use of a hand-held Jackson cross cylinder (J.C.C.). The stability provided by the phoropter-mounted J.C.C. was sacrificed by the handheld method. Because of this, arriving at an acceptable endpoint was difficult when attempting to refine both the cylinder and axis components. This was reflected by a larger discrepancy in the axis and cylinder when changing from trial frame refraction to phoropter refraction.

Finally, it should be noted that virtually every subject tested commented that the trial frame was uncomfortable. This lack of comfort may have diverted the attention of the subjects enough to contribute to the discrepancies noted.

Conclusion

Discrepancies did exist when comparing trial frame to phoropter refraction. The component most likely to change was the spherical finding. However, the discrepancies found in the spherical component were for the most part minor. This can be explained by the variability of the vertex distance that occured when refining the spherical component. Although the axis and cylinder components were less likely to change than the spherical, the discrepancies were more marked when they occured. This can be attributed to the instability of the hand-held Jackson cross cylinder and the difficulty in arriving at an acceptable endpoint. The lack of patient comfort necessitates an expedient examination. However, a balance between expediency and thoroughness must be achieved to avoid procedural error. The discrepancies found during this investigation could be minimized by practice and recognition of those trial frame procedures most prone to human error.

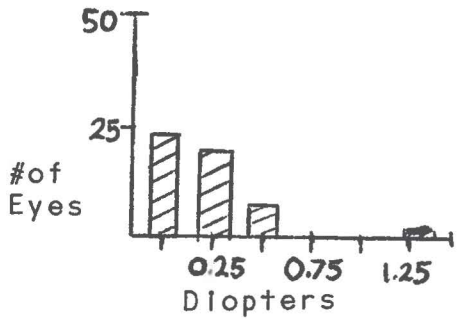
Table 1: Trial frame vs. phoropter refraction

I Spherical component
- A. % of 50 eyes showing no change: 48%
- B. % of 50 eyes showing change: 52%
  1. 73% = 0.25 diopter change
  2. 23% = 0.50 diopter change
  3. 4% > 0.50 diopter change

II Cylinder component
- A. % of 50 eyes showing no change: 56%
- B. % of 50 eyes showing change: 44%
  1. 59% = 0.25 diopter change
  2. 23% = 0.50 diopter change
  3. 18% > 0.50 diopter change

III Axis component
- A. % of 50 eyes showing no change: 60%
- B. % of 50 eyes showing change: 40%
  1. 5% = (1-4) degree change
  2. 50% = (5-8) degree change
  3. 25% = (9-12) degree change
  4. 20% = (13-15) degree change

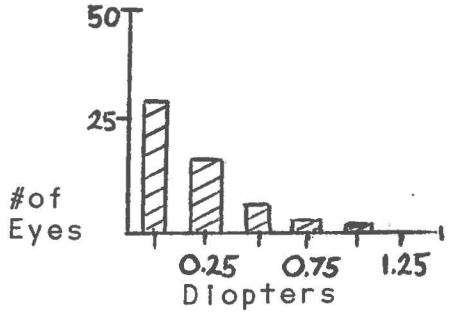
(Figure 1.)



Spherical Component

Diopter Change	#of eyes
0.00	24
0.25	19
0.50	6
0.75	0
1.00	0
1.25	1

(Figure 2.)

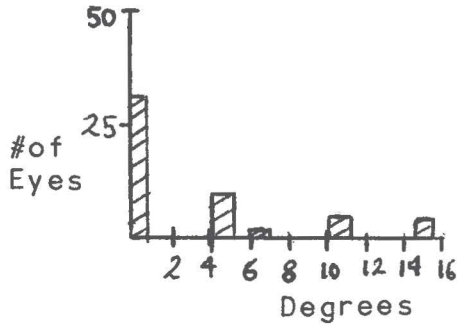


Cylinder Component

Diopter Change	#of eyes
0.00	28
0.25	13
0.50	5
0.75	3
1.00	1

(Figure 3.)

Axis Component



Degree Change	#of eyes
0	30
1-2	0
2-3	0
4-5	10
6-7	1
8-9	0
10-11	5
15	4

Bibliography

1. Maeda, Andrew, O.D. "Trial Frame Refraction." Optometric Monthly, pages 122-126, October 1979.
2. Murphy, Dennis, O.D. "How to make a thorough house call". Review of Optometry, pages 4-6, November, 1979.