The Borish Vectographic Nearpoint Card II™

Instruction Manual

developed by

Ophthalmic Research Institute

manufactured by

Stereo Optical Company, Inc.

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GENERAL INFORMATION

The Borish Vectographic Nearpoint Card II is used in binocular refraction and testing near vision. The unique characteristic of the card (like its predecessor) is that it allows a number of tests to be performed monocularly with both eyes open and with convergence maintained on a bifixated target. [1] This revised version of the card also contains tests for stereopsis which were not part of the original.

The two sided card is printed with vectographic polarized images which, when viewed with appropriately oriented analyzers, provide separate images for each eye. Some portions can be seen with both eyes. Included are targets for measurement of visual acuity, phorias and vergences, fixation disparity, associated phoria, and stereopsis. All specifications are given with respect to a 40 cm distance.

One side of the card has grid targets used for monocular and binocular cross cylinder tests, letters for the measurement of monocular and binocular visual acuity, and a phoria target.

The second side has targets for stereopsis testing: real contours and random dot figures. The real contour figures are perceptible in depth by most individuals possessing normal binocular vision, but also offer monocular cues, especially at the higher disparity levels. The random-dot figures offer no such monocular clues, and therefore may be more reliable in determining the stereo threshold. It should be noted that some individuals with normal stereopsis are unable to appreciate depth in random-dot stereograms, and the real contours must be used. The second side has two additional targets used for the measurement of horizontal fixation disparity and associated phoria.

INSTRUCTIONS FOR USE

ILLUMINATION

The card should be mounted on the near point rod of the phoropter and viewed through standard polarizing analyzers dialed into place before the patient's eyes. The distance should be 40 cm (16 inches). Uniform illumination is important. Approximately 800 – 1000 lux (80 – 100 foot-candles) or about the level produced by a standard 60 watt nearpoint lamp at 35 cm (14 inches) is recommended. Also, because of the shiny surfaces of the vectograms, some care must be taken that the patient does not perceive a specular reflection of the illuminant.

CROSS-CYLINDER TARGETS

Three targets are presented, and are seen OS, OU and OD, left to right. They are to be viewed through cross-cylinders before both eyes, with the minus axis vertical (at 90 degrees).

The patient is asked whether the vertical lines of each grid appear bolder, blacker, or more distinct than the horizontal. If the horizontal lines appear more prominent, this indicates low accommodative facility in the non-presbyope, or the need for near add in a presbyope. This is measured as the amount of plus sphere needed before each eye until the lines are equally distinct, or until the vertical are more pronounced.

Equality of the lines or more distinct vertical lines indicates adequate accommodative response. Differing amounts of plus required before the two eyes to equalize the respective monocular targets may be highly significant. This is discussed further below.

ACUITY TARGETS

Nearpoint acuity targets enable measurement of the nearpoint acuity both monocularly and binocularly. Ordinarily

the binocular acuity may be slightly higher than the monocular acuities. However, inequality of the nearpoint acuities of the two eyes, particularly if the distance acuities are equal, is important and should be noted.

These targets are also used for measuring the amplitude of accommodation, monocularly and binocularly. With the patient viewing the finest visible line on each chart as seen at the original distance, the card is brought closer to the patient according to Donder' method. [2] The patient is requested to report the point at which that line blurs for each of the three charts. The optical equivalent of the distance from the eye to the blur-points, less any assisting lenses which may have been added, represents the amplitude for each eye and for both eyes together.

The binocular amplitude may be somewhat greater than the monocular amplitudes, but inequality of the two monocular amplitudes is significant.

Some practitioners use the method introduced by Sheard of adding minus lenses before the eyes, with fixation at the original nearpoint test distance, until the print blurs. The equivalent of the working distance is added to the lens powers to arrive at the amplitude of accommodation. It should be noted that Sheard used this as a method of measuring monocular amplitude only, and for binocular amplitude the value is likely to be less than that obtained using the Donders method.

Plus and minus relative accommodation may be measured by adding plus or minus lenses respectively until the fine print on the binocular chart blurs. Since the monocularly observed targets will also blur, any inequality of the two eyes should be noted.

UNEQUAL RESPONSES AT NEAR

The major feature of the Borish Vectographic Nearpoint Card is that it permits simultaneous assessment and comparison of the two monocular functions as well as the binocular. This is not possible with ordinary nearpoint tests.

Unequal monocular results in the cross-cylinder, amplitude of accommodation, or positive/negative relative accommodation tests usually indicates unequal accommodative effort or reserves between the two eyes. The two eyes may also reveal differing nearpoint acuities despite equal distance acuities.

Such results suggest that the basis of the inequality should be determined. One possible cause may be an error in equalization of the distance correction. If this is rechecked and found not to be the cause, differences in lens effectivities at near of the respective distance corrections should be considered, particularly if any substantial anisometropia exists. Also, cyclotorsion induced by convergence may affect the optical imagery relative to the cylinder axes found at distance. The cyclophoria accompanying any vertical phoria may have misled the true location of the distance cylinder axis.

The axis and power at near for the distance cylinder correction can be assessed and modified. The patient is instructed to fixate the letter charts while the usual technique of the Jackson Cross Cylinder (JCC) [3] for axis and power is employed for one the eyes. To help maintain accommodation, the patient is asked to alternate fixation from the tested eye's target to the fellow eye's target and to hold the best line of acuity of the untested eye as consistently clear as possible.

Finally, a genuine inequality of accommodation due to either differences in crystalline lens elasticity or accommodative innervation may actually be present. Unequal findings at nearpoint between the two eyes, due to any of the above

causes, which cannot be remedied by a change in the equalization of the farpoint correction, may suggest the desirability of prescribing unequal bifocal additions for the two eyes; this indication is completely unavailable from non-vectographic nearpoint analyses.

HETEROPHORIAS

The diamond enclosing five rows of letters is used for measuring phorias with the Von Graefe method.[4] This target is visible to both eyes and, accordingly, the analyzers may be removed if desired. A prism before one eye dissociates the target into two, and the variable prism before the other eye aligns the targets either vertically or horizontally. The fine letters within the diamond serve to hold the patient's accommodation fixed, because a phoria measurement made with accommodation varying has little meaning. That a simple spot, light or dark, cannot adequately stabilize accommodation is the reason measurements made with such a stimulus are relatively useless.

Rotary prisms are placed before both eyes, the left eye with vertical power and the right eye with lateral power. The patient is asked to fixate the finest letters within the diamond which can be seen clearly and to maintain that clarity throughout the test. Base-up prism, usually 6 to 8 Δ, is introduced to the left eye to break fusion and dissociate the target vertically. Prism base-in is increased for the right eye until the patient reports the upper chart to the right of the lower by a distance somewhat greater than the size of the diamond.

FIXATION DISPARITY

The fixation disparity assessment procedure allows the examiner to measure any small lateral misalignment of the visual axes present under fused binocular conditions, and to determine what changes may occur when lenses or prisms are

interposed. Either prisms or lenses may be used to change the vergence or accommodative demand, and the resulting fixation disparity is noted for each optic used. Graphing of the results allows the examiner to determine which of four classic fixation disparity types a patient may have.[5] Analysis of the resulting curve provides information that can be used to prescribe prism or added lenses, and to monitor results of vision therapy.

The fixation disparity target is located at the lower left beneath the random dot figures. It consists of a horizontal scale of vertical lines whose relative positions are in ten minutes of arc increments specified by the numbers and letters 3,2,1,0,A,B,C reading left to right. (The subdivisions are 5'.) The scale and the letters and numbers are visible to both eyes. The triangles above and below the scale are seen only by the right and left eyes respectively. The perceived position of the monocularly visible triangles relative to the binocularly visible scale is a measure of the magnitude of the horizontal fixation disparity for each eye.

ASSOCIATED PHORIA

The associated phoria test is a quick determination of the prism required to reduce fixation disparity in both the horizontal and vertical directions. The test provides a portion of the information of the fixation disparity test without the sometimes time-consuming need for a complete analysis of the fixation disparity curves. Prism determined in this manner can be prescribed for vertical misalignments with confidence that it will relieve the patient's symptoms. Lateral prism prescriptions may be less successful when this test is used, and when this is a consideration in treatment, the entire curve should be assessed using the fixation disparity methods. [6]

The associated phoria target is a modified Mallett [7] test and appears at the lower right. The four circles and the central cross are visible to both eyes, and provide the stimulus to

binocular fusion. The lower and left bars are visible to the left eye while the upper and right bars are visible to the right eye. The amount of vertical prism necessary for vernier alignment of the horizontal line segments is a measure of the vertical associated phoria; the amount of horizontal prism to achieve alignment of the vertical lines is a measure of the horizontal associated phoria.

VERTICAL PHORIA

The patient is asked to concentrate on the fine print in the right-upper target (which is seen by the right eye). The prism power in the left eye is reduced until the small point at the right corner of the initially lower diamond (seen by the left eye) is in horizontal alignment with the small point at the left corner of the initially upper target (seen by the right eye). The prism power remaining before the left eye shows the extent of vertical phoria – right hyperphoria if it is base-up and left hyperphoria if it is base-down.

LATERAL PHORIA

The prism before the left eye is then returned to its original dissociating position (6-8 Δ base up) and the patient is asked to keep the smallest visible print clear in the left target. The prism base-in before the right eye is now reduced until the small point at the bottom of the top diamond is reported to be aligned with the small point at the top of the bottom diamond. The amount of prism remaining in the right eye indicates the amount of lateral phoria – exophoria if the prism is base-in, and esophoria if the prism is base-out.

PHORIA GRADIENT

When the prism is in the alignment which indicates lateral phoria, with out any further change in the prism for either eye, +1 diopter lenses are introduced before both eyes. This reduces the accommodative stimulus and relaxes accommodation and thus accommodative convergence. The phoria will change to the extent that the accommodative convergence has relaxed. Usually the upper target will move to the left and additional prism base-in will be needed to realign the two diamonds. The difference in the readings of the original phoria finding and the gradient finding is an indication of the AC/A ratio. For example if the nearpoint finding were 5 base-in and the gradient were 8 base-in, the difference would be 3 prism diopters and the AC/A ratio would be 3/1.

Some practitioners prefer to measure gradient with minus lenses. This has some theoretical advantage, since it increases the stimulus to accommodation. Note that the positive and negative gradients are not always the same, depending upon the patient's responses. However, since plus for near is often a prescription component, the positive lens gradient may have broader applicability.

VERGENCES

The lateral and vertical vergences can be measured by having the patient again fixate the finest print readable and requesting notification when (1) the print blurs; (2) the diamond dissociates into two diamonds, or (3) the diamond, previously still, starts to move to either side. Negative Fusional Convergence can be measured by increasing prism base-in to equal extents before both eyes, resulting in the blur point when the print blurs and the break point when the diamond doubles. The recovery point is found by reducing the prism until the

doubled diamonds return to a single one. If the diamond starts to move laterally, one eye is suppressing and the Fusional Convergence limit has been reached just as if diplopia has occurred. The Positive Fusional Convergence is similarly measured by turning prism base-out. Right Supra Vergence can be taken by increasing base-down before the right eye while base-up is increased before the left, and Left Supra Vergence by the reverse rotation of the prisms.

CARE AND HANDLING

The vectographic surfaces of the card are robust enough to last many years with appropriate care. Avoid permitting fingerprints or other foreign material to accumulate. If needed, a gentle cleaning with a slightly moistened tissue should be sufficient. Be particularly careful not to abrade these surfaces.

Avoid long periods of exposure of the vectograms to bright illumination, particularly with high UV content.

SCORING KEYS

ACUITY CHARTS

Each of the three acuity charts consists of ten rows of Sloan letters with five letters per line. [8] The same letters are used on each row of all three charts, but for each the letters are presented in a different sequential order: for the left and right charts the letters on each row are in reverse order; for the center chart the same letters are in a random sequence. The ten rows of letters for the charts are graded in size in equal logarithmic steps of minutes of arc, referred to as logMAR. [9] The progression of letter sizes is given below in both the logMAR and the approximate Snellen equivalent.

Line	LogMAR	Snellen	OS	OU	OD
1	0.7	40/200 (20/100)	DKRSN	KSNDR	NSRKD
2	0.6	40/160 (20/80)	ZVOCH	ZHOVC	HOCVZ
3	0.5	40/120 (20/60)	NHSRC	CRNHS	CRSHN
4	0.4	40/100 (20/50)	CDVZK	DVCKZ	KZVDC
5	0.3	40/80 (20/40)	HONRS	NRHOS	SRNOH
6	0.2	40/60 (20/30)	RCKDH	KHCRD	HDKCR
7	0.1	40/50 (20/25)	ZOVCN	VNZOC	NCVOZ
8	0.0	40/40 (20/20)	RNCKD	RDNCK	DKCNR
9	-0.1	40/32 (20/16)	ZOHSV	VHZOS	VSHOZ
10	-0.2	40/25 (20/12.5)	KNRDO	NKODR	ODRNK

STEREOPSIS TARGETS

The real contours consist of eight clusters of four rings each. One ring in each cluster appears at a different depth from the other three; the test target has crossed disparity so it will appear nearer. The angular disparities, which provide the appearance of depth are graded in steps of 0.3 log seconds of arc (that is, each cluster has a disparity half as large as its predecessor.) This test is used by asking the patient to identify which ring in each cluster (top, bottom, left or right) is at a different depth. The stereo threshold is the value associated with the last cluster which the patient is able to correctly identify.

The clusters are in decreasing order of disparity beginning at the upper left, progressing to the right, followed by the lower row, again left to right:

Cluster	Disparity	Location
1	1280 sec	Right
2	640 sec	Top
3	320 sec	Right
4	160 sec	Bottom
5	80 sec	Left
6	40 sec	Left
7	20 sec	Top
8	10 sec	Bottom

The random dot stereo test consists of eight squares of random dots that can be resolved by one having 20/80 acuity or better. A symbol in the form of an illiterate E is visible to most who have binocular vision. The orientation of the E is random and appears in depth (nearer than the background square) in one of four possible orientations: arms of the E pointing to the left, right, up or down. The eight different levels of disparity are the same as for the real contour stereotests.

Cell	Disparity	Orientation
1	1280 sec	Right
2	640 sec	Up
3	320 sec	Down
4	160 sec	Right
5	80 sec	Down
6	40 sec	Up
7	20 sec	Left
8	10 sec	Left

PHORIA TARGET

The target for vertical and lateral phoria contains five rows of letters enclosed within a diagonally oriented square. The Snellen sizes of the letters on each row are

Row	Snellen	OU
1	40/80 (20/40)	Z N
2	40/60 (20/30)	H D K C R
3	40/50 (20/25)	N C V O Z
4	40/40 (20/20)	D K C N R
5	40/32 (20/16)	V S H O Z

ACKNOWLEDGEMENTS

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