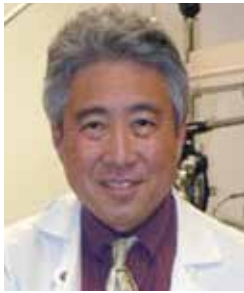


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The case of the suddenly-monocular patient

Abstract

When one eye has very poor visual acuity, it is usually considered a “balance eye” and not considered functional. Once the loss of vision occurs in one eye, binocularity is typically no longer considered, and eye dominance is often automatically associated with the eye that has the better visual acuity. The following is an example of a fictitious patient that mimics a number of cases I have seen. The etiologies include monocular branch retinal vein occlusion (BRVO) and dry age-related macular degeneration (ARMD) in both eyes (OU). The patient was seen by several eye care practitioners before the diagnosis was correctly addressed and the rehabilitative process facilitated.

Key words

Visual field, Retinoscopy, Balance Eye, Binocularity

Introduction

Too often a patient’s visual acuity is used as the only criterion of functional vision and is assessed by a nearly 100 percent contrast chart. Visual field testing is frequently not performed by practitioners as they see even a low vision evaluation as being driven primarily by a patient’s visual acuity status of the better eye.¹

Case report

A 70-year-old Caucasian female presented with a six year history of ARMD in both eyes. She now has a three month history of BRVO in the right eye, which has been her better-seeing eye for the past five years.

The left eye has a 1+ posterior subcapsular cataract (PSC) and 2+ nuclear sclerosis (NS), OD has ½+ nuclear sclerosis (NS). The distance unaided visual acuity (V/A) in that eye is OD 10/140, OS 10/30+, OU 10/80, and near unaided visual acuity (V/A) is OD 6M and OS 2.0M at 40 cms. Her family ocular history of maternal ARMD was diagnosed at the age of late 70s; paternal cataract extraction diagnosed at 80s-years-of-age. The only systemic medication is Xanax 0.5mg as necessary (PRN) for the past 2.5 months for episodic anxiety over ocular problem. The patient has been worked up for carotid artery insufficiency or stenosis that is negative. Additionally, the patient has never been diagnosed hypertensive. She has seen three ophthalmologists — one general practice and two retinal specialists (latter for a second opinion) — with no treatment suggested other than a low vision rehabilitation referral by second retinal specialist. The patient has seen a primary care doctor of optometry referred to by the first retinal specialist that resulted in a progressive multifocal spectacle prescription of OD -2.00-1.50x090 and OS -2.25-1.50x080, +3.00 add for full-time wear. The corrected distance VA with these is OD 10/225, OS 10/20-2, OU 10/40- and the near point is OD 6.0M, OS 1.6M at 33 cms. Additionally, laptop computer viewing distance VA is OD 4.0M, OS 2.5M at 50 cms.

She reported formerly wearing over-the-counter (OTC) readers, one for using a computer and another for reading.

The visual field of the right eye is shown in Figure 1. Retinal photos of the right eye shows 3+ large blot intraretinal hemorrhages extending beyond the superior arcade and involving the superior macula, including the foveal avascular zone (FAZ). The macula area of this eye also

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shows 1+ small drusen. The left eye has 1+ small drusen in the FAZ, but is otherwise unremarkable except for slight blurring of details due to the lenticular opacities.

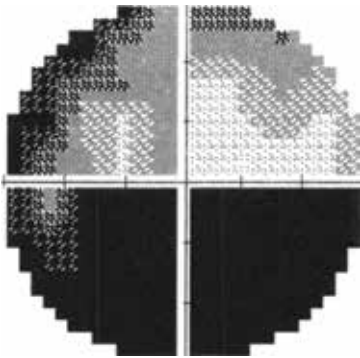


Figure 1: Visual Field OD of Right Eye

The patient is having extreme coping problems with her vision status, namely:

- She cannot discern faces beyond 20 feet.
- She is having problems with even two-step stairs in judging depth and in locating the doorknob as if eye-hand coordination is impaired.
- Reading is described as “the text is moving” and episodic vertical diplopia is increasing in frequency.
- Computer is almost impossible to orient - screen magnification software makes her nauseous (she is a semi-retired management consultant).
- She used to go day hiking with friends, but cannot discern the trail boundaries now.
- She has a real problem in changing lanes while driving and judging the distance of the car ahead of her, even though she has a self-limited driving period. Curiously, she has little problem with street signage, except when driving near dusk or before 9 a.m.

There are at least several key elements in this case that have not been taken into account. One has to remember that the patient says that the right eye was the **better eye** prior to the BRVO event. This means that it was the dominant eye, and probably not only because of the visual acuity. She did not wear any spectacle correction habitually and the left eye assumedly had the lenticular opacities, so it was blurred for distance.

One cannot change eye dominance instantaneously just because the left eye has a better field and better acuity. Another factor is measuring with a retinoscope in the patient’s better visual field (superior) to ascertain the refraction measure. This is especially important because it appears that the progressive multifocal has a ‘balance lens’ power in the right eye.

She could not have been this myopic in the right eye formerly without symptoms for driving and hiking. An autorefractor will not even operate if the patient is not fixating centrally and cannot measure at an eccentric field angle, whether it is the patient trying to fixate, or we are trying to measure off-center.

Also, the patient’s binocularity does not simply vanish and she then becomes monocular, especially if there is at least 50 percent of the field available. A progressive multifocal, even with digital surfacing, still has mid-peripheral distortions which cannot be helpful when a significant area of the dominant eye cannot help compensate, especially in the inferior fields. On the computer, it is not surprising she is nauseous, especially with screen magnification, compared to a single vision lens equivalent.



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Although the traditional visual acuity test is excellent for quantifying foveal vision, it tells the clinician nothing about the peripheral retina, and in measuring the peripheral retina, rather than asking the patient to identify letters, the patient is just asked to respond to the presence or absence of a spot of light.²

When holding a Feinbloom Distance Chart in the patient’s intact superior field, it was determined, to her delight, that she could discern optotypes that were at a 10/40 level, which is obviously 3.5 times that found in primary gaze or on a chart that is on a stand/chair that is lower than eye level.

In taking this one step further, when utilizing what some regard as archaic, a retinoscope with a lens bar in her superior field (that means we are standing up and measuring), the refraction measured +0.75-0.25x020, and although this did not further increase the objective acuity beyond the 10/40 level, it certainly did not blur the vision, as the balance lens described

above, by over-minussing the right eye by an equivalent sphere of 3.12D.

This can be a major etiology for the patient's mobility problem in trying to ambulate on stairs, driving problems and locating the distance of a doorknob. Studies by Burg, et al., found that static visual acuity has an extremely weak relationship to traffic accidents; good acuity is helpful when the vehicle is stopped or moving slowly since unlike real scenes which vary in complexity, contrast and illumination, the stimuli used to measure visual acuity are small, high contrast and low complexity.²

With this patient, the Pulfrich Phenomenon seems to be invoked, not only because of the inferior hemianopsia, but also because of the blur caused by the balance lens. The Pulfrich Phenomenon states that if a neutral density filter is placed before one eye, an object moving in the horizontal plane will appear to have a rotational movement instead.^{3,4} Image manipulations via monocular blur, monocular luminance reduction or disjunctive image motion have been recently found to result in a significant decrease in perceived depth (elevated the stereothreshold by 3.7-5.5x) compared to a pair of clear images; stereotargets that are blurred in either one or both eyes generate a broader potential image of retinal image disparities.⁵ Walking provides a common source of retinal-image motion.⁶

While it was stated in the initial referral information that the left eye visual field was unremarkable, we are starting to see that a binocular assessment is necessary to assess general orientation. The only visual field technique that can be easily adapted for binocular testing is a tangent screen (Figure 2) without occlusion. When this was performed, a relative scotoma was found in the inferior field OU. Equally important is that the tangent screen can be instructive to your patient in showing them where the field is intact and where it is not. In identifying faces, older adults are at a disadvantage in



Figure 2: Tangent screen without occlusion.

recognizing faces at lower ambient light levels than younger adults, needing approximately twice as much contrast to detect and discriminate.²

“...most low vision patients lack the highest form of binocularity: depth perception by parallax or stereopsis.

The best psychophysical measure of recognizing faces is obviously not visual acuity, but spatial contrast sensitivity.² In principle, stereopsis could be a useful binocular cue in recognizing ground-plane irregularities, but stereoacuity declines at low spatial frequencies and unequal contrasts between the two eyes.⁵ Her difficulty in orienting on a day hike trail was partly age-related in that the binocular visual field declines from approximately 180 degrees to 140 degrees by age 70², but obviously over-minussing her in the dominant eye and having the Pulfrich Phenomenon to deal with becomes additive in creating a deficit.

In demonstrating the field to her, we discussed having her eccentrically view downward as if the patient was wearing a bow tie to further decenter the inferior field. The patient was quite delighted at this simple tactic, and this, along with much-needed rehabilitative training, was referred to the low vision occupational therapist for daily living skills application. Given the situation and findings, we also were able to refer her to an orientation and mobility specialist once we converted her spectacle to the correct anisometric state and a single vision lens. A yellow filter of 450nm was found to be efficacious in enhancing contrast in the right eye, a 511nm filter was found to be such in the left eye, but in OU testing, a 450nm filter was utilized. The filter helped to decrease her just noticeable difference (JND) in the trial frame refraction of the right eye by 50 percent when taking into account the superior field. A BPI Total Night tint can be utilized thusly, or if photochromatic is preferred, an X-Cel Autumn Gold lens, the latter being made in Trivex only.

In addition, binocularity at distance and near point should not be overlooked; most low vision patients lack the highest form of binocularity: depth perception by parallax or stereopsis. Gross stereopsis is present. When two dissimilar images are presented, retinal rivalry exists, especially with recent macular changes in one eye.¹ In this instance, the patient generally complains about words running together or that print appears blurred even when they are at the exact focal point of the low vision system. For those patients who have a visual acuity difference of about 1.5, investigation of binocularity is important.¹ Binocularity has certain advantages, including: 1) psychological, 2) the visual acuity and visual fields are larger, 3) contrast sensitivity should be enhanced

and 4) stereopsis of any shape or form is only possible in a binocular state.¹ The practitioner should evaluate both motor and sensory binocularity. Motor binocularity includes cover test, Hirschberg test and vergence testing. Sensory includes Worth 4-dot, Maddox Rod (on poorer vision eye), 4 prism test (rotating until diplopia), stereo fly or reindeer.¹ Our case found, by Maddox Rod presented to the right eye (larger target than a transilluminator or penlight), that she measured a right hypophoria of 6 prism diopters and 2 exophoria.

Because of the large amount of vertical phoria, the patient was informed that some of the measurement could be attributed to her altitudinal hemianopsia, but that the practitioner's experience showed it was an exaggeration of a pre-existing binocular condition; she was fortunate to only have episodic diplopia when reading since even 50 percent of this amount should be causing other problems.

She then admitted that she had been experiencing occasional diplopia when viewing television, but this had been going on for years prior. At that point, because of the uncorrected myopia of the left eye, one of the diplopic images was quite blurred and she could easily suppress it. It turned out that her professional eye care prior to the BRVO event had been quite infrequent, with the diagnosis of the left eye cataract five years previously when at the state Department of Motor Vehicles she noted the inequality of vision that caused her to seek a diagnosis. The dry ARMD was also noted then, and fortunately her eye care practitioner had informed her of lutein and antioxidants research. The provider addressed the hypophoria with 2.5 prism diopters of vertical prism. The computer problem was addressed with single vision lenses and prism, which then eliminated subjective word movement. In a low vision assistive technology evaluation, reverse polarity (white print on black) was deemed much easier and she was given a simplified assistive technology regimen to implement.

Conclusion

This case exemplifies how low vision care does not always involve telescopic or magnifying aids, whether optical or electronic. A thorough and unbiased approach to rehabilitation that does not emphasize visual acuity as the determinant is paramount in a high percentage of cases. Utilizing a functional visual field, retinoscopy and assessing binocularity, were extremely important facets of her rehabilitation.

Visually impaired patients require more than visual acuity assessment to diagnose their impairment. Over-simplifying the case by dismissing binocular input and eye dominance is a mistaken generalization, as is often done by non-low vision

practitioners. Utilizing our knowledge of visual psychophysics demonstrates why patients have more daily problems than a high-contrast visual acuity chart would purport to exemplify. This patient certainly benefitted from a multi-faceted optometric and multi-disciplinary approach for successful rehabilitation.

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