A successful case of yoked hemi-prism in a hemianopic cyclist

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BACKGROUND

Hemianopic visual field loss is common among patients with acquired brain injuries including head trauma and 20-30% of stroke patients. The majority of these defects are caused by occipital lobe lesions, followed by optic radiation and the optic tract. Complete resolution of this field defect occurs in 10% of post-stroke patients while 50% will experience partial resolution. This spontaneous recovery will occur within the first three to six months.

Visual field loss can affect a person's ability to continue performing daily activities and may make them more dependent on others. Individuals with a hemianopic field loss are at a higher risk for falls. It is important to diagnose these patients early in order for them to receive the appropriate treatment and prevent injury from falls. This field loss can also make it difficult for an individual to read. With a left hemianopia, an individual with have difficulty making a return saccade to the beginning of the next line and may then lose their place while reading. A right hemianopia will impair the individual's ability to know where their eyes should scan to for the next word.

Different prism systems can be used to increase visual field awareness.

(1) Peli prism is an uni-ocular and is placed on the lens on the same side as the visual field loss. Fresnel prism segments of 30-40 prism diopters is placed on the superior and inferior quadrants of the carrier lens in the direction of the visual field loss. This system works through superimposition of what the person is seeking in their line of sight and what is in their area of visual field loss.

(2) Yoked prism is a full-field or hemi-field prism system. It will reduce the need for excessive head and body movement in order to see targets within the space of field loss. Full-field yoked prism has limited use for ambulation but is effective for tasks such as reading, computer use and watching TV. The ideal amount for distant viewing is between 15-20 prism diopters and for near tasks is 6-10 prism diopters both in the direction of visual field loss. Hemi-field yoked prism works like a rear-view mirror. The segment is placed out of the line of sight and is place on the side of the field loss. The most effective power is 18-20 prism diopters.

With any of these systems, the patient will need neuro-optometric rehabilitation therapy to enhance their scanning ability and allow them to use their prism more efficiently.

CASE REPORT

A 55 year old Caucasian male presented to the clinic complaining of left-sided field loss, bumping into objects on the left side, difficulty reading printed material, feeling overwhelmed in grocery stores and feeling apprehensive while cycling. The patient's medical history was remarkable for three cerebral vascular accidents within the past two years. His ocular history was remarkable for PRK and being a glaucoma suspect. He had a history of scanning therapy with an occupational therapist but he reported still being bothered by the field loss while cycling.

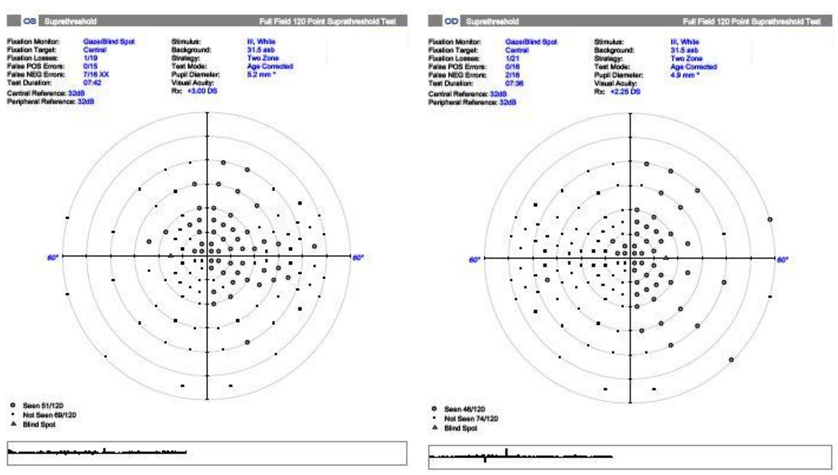

Figure 1. Humphrey Full Field 120 Point Visual Field showed a left homonymous hemianopia with an inferior arcuate defect OS.

Test	Findings
scDVa	OD:20/20 OS: 20/20
Pupils	PERRL, (-)APD
EOMs	Full and comitant
Confrontation Visual Field	OD: restriction nasally OS: restriction temporally
Fixation	No intrusions OD, OS
Saccades	Mild undershooting in all gazes
Pursuits	Smooth and full
Cover test	scDistance: 2XP ccNear: 2XP
NPC with accommodative target	8"/9", good re-grasp
NPC with non-accommodative target	7"/8", good re-grasp
Manifest Refraction	OD: -0.25DS VA 20/20 OS: +0.50DS VA 20/20 ADD: +2.00 NVA 20/20
Distance phorias	1pd exo
Near phorias	8pd exo
Vergence ranges	DBI: x/7/0, DBO: x/8/6 NBI: x/21/18, NBO: x/12/3
DEM	Vertical: 27.30 seconds, 80-85% Horizontal: 28.39 seconds, 90% Errors: 0, 60-99% Ratio: 1.06, 85%

Figure 2. An example of spectacles with Peli-prism base left.

Figure 3. Hemi-prism spectacles made with Fresnel prism base left.

Figure 4. Hemi-prism ground in to spectacles. This is ground in base right whereas the patient's prism would be ground in base left.

Structure	Findings
Lids/Lashes	Clear OU
Conjunctiva	Clear OU
Cornea	Clear OU
Iris	Flat and intact OU
Angles	4/4 OU
Anterior Chamber	Deep and quiet OU
Lens	Clear OU
Vitreous	Clear OU
C/D and Optic Nerve	0.85 round OU with mild rim thinning 360 degrees
Macula	Flat and intact OU
Vessels	Normal OU
Periphery	Flat and intact 360 degrees OU

CONCLUSIONS

This patient was diagnosed with a mild convergence insufficiency and was deemed a good candidate for yoked prism for reading and yoked hemi-prism for distance. Convergence and scanning therapy procedures were initiated with home neuro-optometric rehabilitation therapy. Three months later the patient was scheduled for in-office neuro-optometric rehabilitation therapy to enhance convergence, reduce visual-vestibular symptoms and trial prism for reading and cycling. Scanning therapy included slingshot saccades, 3-point scanning, and rear view mirror techniques. The most effective prism for all near therapies was 6 prism diopters base left. For distance, Peli prism (Figure 2) was trialed in-office first, the patient reported he felt his field was not greatly expanded. 20 prism diopters of base left yoked hemi-prism made with Fresnel prism (Figure 3) was trialed second. The patient reported a greatly expanded field of vision to the left. Therapy with the hemi-prism was initiated to enhance scanning skills. As he became more efficient with his scanning abilities, cycling videos were added over the targets to be scanned to help the patient become more aware of vehicles and other cyclist on the road by using the prism as a rear-view mirror. After 11 therapy sessions, the patient was instructed to continue wearing the prism for 1 month and return for re-evaluation before grinding the prism into his distance glasses. The patient reported that he felt had the majority of his visual field again and that he was no longer as apprehensive cycling. He reported he was no longer bumping into people when walking and was much more aware of vehicles approaching him on the left while cycling on roads. A prescription for distance vision glasses with ground-in hemi-prism was released (Figure 4).

To increase the success of using a prism system, a patient needs to be actively involved in a visual therapy program first to eliminate any oculomotor, binocular or visual perceptual deficits and then to develop efficient scanning techniques to expand their visual field awareness. If the patient is not properly trained on how to use their prism correctly, there is a higher risk of the patient responding negatively to the prism. Better understanding of how to use yoked-hemi prism with proper scanning therapy is beneficial for all clinicians who deal with hemianopic patients.

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