Consideration of Optical Scotomas in Designing Visual Field Expansion Devices

Nicole C. Ross1,2, Alex R. Bowers2, Eli Peli2

1New England College of Optometry, Boston, MA 2Schepens Eye Research Institute, Dept. Ophthalmology, Harvard University Medical School, Boston, MA

Background

Prisms are used in rehabilitation of hemianopsia to expand or relocate the visual field (VF). In addition to shifting images to a functional part of the VF, they also create a scotoma at the apex of the prism. This prism apical scotoma (PAS) could compromise areas of remaining vision.

Methods

Patients with homonymous hemianopsia (n=4) wore habitual prism spectacle with unilateral prism segments (40Δ). Normal Vision subjects (n=4) also wore spectacles with unilateral 40Δ prism segments.

Research Questions

1. Does the prism apical scotoma (PAS) impact binocular viewing?
2. Can we predict the position of the PAS?

Fitting Prisms for Hemianopsia

Unilateral Segment Prism (Traditional Clinical Practice):

A prism segment is base-out on the side of the hemianopsia.

Horizontal Peripheral Prisms (New Method):

PAS were placed 10 mm above and below pupil.

Oblique Peripheral Prisms (Expansion more central):

The upper segment is placed base down and base out on the side of the hemianopsia while the lower segment is placed base up and base out.

Visual Field Impact - cont.

• PAS of 4° in binocular view
• 10° expansion from prism

Conclusion

Though higher prism powers give greater VF expansion, the accompanying PAS is larger and could impact central areas of theVF in binocular viewing.

• Calculations of PAS position can provide a guide to the expected position, and could be verified with VF plots.

References:


Grand Support - NID 1K12EY018930, Dept. of Defense W81XWH04-06 Commercial Relationships: Peli E. Peli

Results

Does the Prism Apical Scotoma Impact Binocular Viewing?

• When the target was presented to both eyes no part of the PAS could be mapped for those wearing 40Δ horizontal prisms.

Can We Predict the Position of the Prism Apical Scotoma?

We compared correspondence between calculated and measured PAS start position and lateral extent for subjects wearing 40Δ horizontal prisms.

Calculating PAS Lateral Extent (LEX): Where: Δ = prism power in diopters (Δ)

Calculating PAS Expected Angular Start Position (A°):