Multiplexing prism glasses for field expansion in bitemporal hemianopia

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Peripheral prisms for Homonymous Hemianopia

- **Peripheral Prisms**\(^2\) (2000)
  - Expand upper and lower segments of the lateral visual field for Homonymous Hemianopia (HH) using Fresnel prisms

Multiplexing Prism (MxP)

- **A-device** that provides simultaneous shifted and unshifted (i.e., multiplexed) views
- The MxP alternates flat areas between the Fresnel prismatic segments\(^3\)

Concept of multiplexing prism

Photo of perimetry grid taken through 40∆ multiplexing prism

**OPS and EPS Configurations**

- **Outward Prism Serration (OPS)**: Commonly used for PMMA Fresnel Peli prism
- **Eyeward Prism Serration (EPS)**: Commonly used for press-on prism

**EPS Prism rotation reduces TIR**

- **EPS Prism rotation reduces angle of incidence**
  - Increase the number of effective prism segments

Optical correction for a left acquired monocular vision using MxP

- **Press on prism (4△)** over the bridge of the nose in wrap-around sunglasses
  - Expands visual field both for prism shift and prism refraction
  - See-through prism eliminates the apical scotoma

Optimize optical correction for BH using MxP

- **Two multiplexing Fresnel prism over the bridge of the nose in wrap-around sunglasses designed to expand nasal fields in both eyes**
- **Parts of expanded visual field of both prism segments may be blocked by the prism segment for the fellow eye**

Nasal field expansion by peripheral prism

- **Temporal retina areas, blocked by the nose, do not function visually**
- **Peripheral prism can expand nasal field of BH**

Apical scotoma in peripheral prism

- **In HH**: The fellow eye covers for apical scotoma
- **In BH**: Apical scotoma is not covered by the fellow eye

Prism Power Variation with Angle of Incidence

- **Deflection angle of actual prism is highly dependent on the angle of incidence**
- **Above a critical angle of incidence, total internal reflection (TIR)**

Apical scotoma covered by see-through view (50% contrast)

Simulated binocular visual field expansion with hypothetical 30° constant deflection power MxP for BH

Conclusion and References

- **Prism segments over the nose bridge expand the nasal visual field for BH & AMV**
- **Nasal prism for BH is affected by optical scotomas**

Expanded visual field of BH using MxP

- **20° visual angle MxP** with DPs over the bridge of the nose in wrap-around sunglasses provides nasal field expansion of both eyes
- **Without apical scotomas**
- **Nasal field was expanded up to 80°** and the interference was almost eliminated

- **Optimized 4△ PMMA Fresnel prisms mounted over the bridge for BH**

H. Jung, E. Peli (2014), Multiplexing prism for field expansion of acquired monocular vision and normal sight.


Poster presented at the Vision 2014 conference, Melbourne, Australia.

H. L. Hyun Jung, E. Peli (2014), Impact of high power and angle of incidence on prism corrections for visual field loss, Optical Engineering, 45(1), 011105.

2) E. Peli (2000), Peripheral field expansion device, United States patent 6: 3, 5F246