Phentolamine Mesylate Treatment of Severe Night Vision Complaints

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BACKGROUND

Night vision problems—including glare, halos, and starbursts—can represent a serious impairment to affected individuals and are often associated with reduced contrast sensitivity [1].

Approaches to improving night vision have included topical treatment with the miotic agents pilocarpine and brimonidine. Pilocarpine is a muscarinic agonist and brimonidine is an α_2-adrenergic antagonist. Both have the effect of reducing pupil size and preventing light traveling through aberrated areas of the peripheral cornea to reach the retina. Eliminating aberrated light has the potential to enhance image quality and reduce glare, halos, and starbursts caused by peripheral aberrations.

Side effects associated with available miotic drops have limited their widespread clinical use as a means of reducing night vision symptoms. Pilocarpine causes a myopic shift in patients' vision and frequently causes headaches [2,3], while repeated use of brimonidine can lead to tachyphylaxis and rebound mydriasis [4].

Phentolamine mesylate (PM) is an α_1-adrenergic antagonist that has also been shown to produce pupillary miosis and may offer a safer and more effective topical alternative to treat night vision problems.

PURPOSE

To determine if reducing pupil size with a single topical dose of PM improves mesopic visual function as measured by visual acuity, contrast sensitivity, and wavefront aberrometry.

REFERENCES

1. Chalita MR, Krueger RR. Correlation of aberrations with visual acuity and symptoms. Ophthalmol Clin N Am. 2004; 17: 135-142.

2. Brown et al. Visual effects of pilocarpine in glaucoma comparative study of administration by eyedrops or by ocular therapeutic systems. Arch Ophathalmol. 1976; 94: 1716-1719.

3. Robin AL. Ocular hypotensive efficacy and safety of a combined formulation of betaxolol and pilocarpine. Trans Am Ophthalmol Soc. 1996; 94: 89-101.

4. Brown SM, Khanani AM, McCartney DL. et al. The Effect of Daily Use of Brimonidine Tartrate on the Dark-adapted Pupil Diameter. Am J Ophthalmol. 2004; 138: 149-151.

METHODS

- **Inclusion criteria**
  - ≥ 18 years of age
  - good general health
  - reports of severe night vision problems
  - score of at least 2 lines or better improvement on mesopic low contrast visual acuity testing (Precision Vision) during contralateral illumination by flashlight.
- **Exclusion criteria**
  - contact lens wear
  - untreated cataracts
  - refractive surgery (LASIK or PRK) or IOL insertion < 5 weeks
  - low blood pressure or heart rate abnormalities
  - investigational drug use within past 30 days
  - use of pharmacologic eye drops within past 7 days
  - use of systemic α-adrenergic antagonists, or hypersensitivity to adrenergic antagonists
  - pregnancy and lactation
- **Active Treatment (N = 16)**
  - 1 drop per eye 1% PM in Tears Naturale II® (Alcon)
- **Placebo Control (N = 8)**
  - 1 drop per eye Tears Naturale II® (Alcon)
- **Measures (Baseline and 2-3 hrs Post Treatment)**
  - heart rate, blood pressure, pupil diameters
  - mesopic and photopic distance high-contrast visual acuity (Optec 6500)
  - mesopic and photopic low-contrast visual acuity (Precision Vision with 5% translucent 5% low contrast chart)
  - mesopic contrast sensitivity at spatial frequencies from 1.5 to 18 cycles (Optec 6500, "far" distance and "night" settings)
  - wavefront aberrometry (Wavescan, AMO)
- **Post-Treatment Safety Measures**
  - pupil roundness and reactivity
  - direct ophthalmoscopic exam on dilated pupils
  - grading of eye redness

Table 1. Study Demographics (47 screened subjects)

Parameter	Placebo	PM
Subjects, n	8	16
Males, n (%)	3 (37.5%)	4 (25.0%)
Mean Age, yrs (SD)	47.4 (13.5)	42.1 (14.6)
Night Vision Complaints, %		
Halos	87.5%	56.3%
Glare Sensitivity	87.5%	93.8%
Starbursts	62.5%	68.8%
Depth Perception	62.5%	68.8%

RESULTS

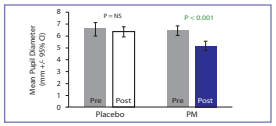

Figure 1. Mean Pupil Diameter by Treatment

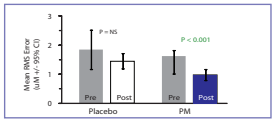

Figure 2. Mean RMS Error by Treatment

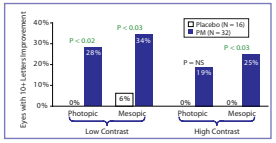

Figure 3. Incidence of Improvement in Visual Acuity of 10 or More Letters by Treatment Group

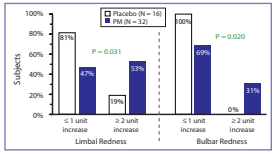

Figure 4. Eye Redness: Changes in Slit Lamp Findings after Treatment

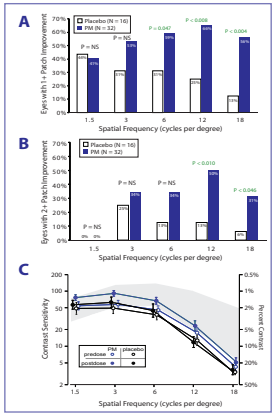

Figure 5. Effect on Contrast Sensitivity WITH Glare

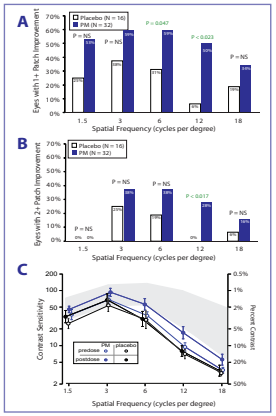

Figure 6. Effect on Contrast Sensitivity WITHOUT Glare

CONCLUSIONS

- Phentolamine mesylate (PM) was safe and well-tolerated, and did not increase either heart rate or blood pressure
- PM significantly decreased mean pupil size (Fig 1), decreased mean RMS error (Fig 2), and improved visual acuity in a significant number of subjects (Fig 3)
- PM was associated with a significant increase in eye redness as assessed by slit lamp examination (Fig 4)
- PM significantly improved contrast sensitivity in both the presence and absence of glare (Figs 5 and 6)

DISCUSSION

Phentolamine mesylate (PM) has the potential to improve functional vision in a large number of patients with aberrated and/or scarred corneas, including patients with night myopia, multifocal IOLs, early PRK or LASIK, as well as several other conditions such as keratoconus, corneal trauma and corneal ulcers. Even some types of early cataract patients may find PM useful.

Mild to moderate hyperemia, a pharmacologic effect of PM, was seen in some patients. This effect, although generally regarded as cosmetic, may concern some patients. One time use of over the counter vasoconstrictors has been shown to minimize this effect (unpublished data) after dosing with PM.