THE ADVENT OF BLUE-BLOCKING IOLs

Throughout life, the crystalline lens protects the retina from hazardous UV light. Cataract extraction removes this protective barrier and may accelerate retinal phototoxicity. To control the amount of radiation transmitted to the retina after cataract surgery, IOLs were created with the capability of blocking UV radiation. All IOLs today block short-wavelength UV radiation up to 400nm. Blue-absorbing chromophores were added to IOL technology in the 1990s to expand protection and decrease the amount of UV-blue energy (400- to 500-nm range) reaching the retina (Figure 1). It was thought that adding a blue-blocking chromophore increased protection from photic retinopathy because it simulated the properties of the natural crystalline lens.1
Although implanting a blue-blocking IOL can increase the amount of retinal protection, there is some argument about whether this filter alters a patient’s visual performance. According to Mainster et al., blocking blue light, although beneficial during daylight hours, can limit visual performance in scotopic conditions, especially in aging individuals (Figure 2). Compared with a conventional lens that only blocks UV light, IOLs with blue-blocking capabilities reduce scotopic sensitivity by 25%. Rodriguez-Galietero et al. compared visual performance measures such as contrast sensitivity and color vision in 40 subjects between the ages of 65 and 70 years. The subjects received a yellow IOL in one eye and a colorless, UV-filtering IOL in their fellow eye. Monocular contrast sensitivity and color vision were assessed for each subject at 3 months post-operatively. The study’s results demonstrated similar contrast sensitivity function at all frequencies between the eyes. Additionally, compared with the colorless IOL, the yellow IOL did not negatively influence patients’ color discrimination.

Night vision can be compromised for older adults with preexisting retinal conditions such as AMD. A study by Owsley et al. investigated disturbances in dark adaptation in patients with early AMD. Twenty older adults (between 66 and 88 years old) with early signs of AMD and 16 adults with normal retinas were measured. Using a Humphrey Field Analyzer (Carl Zeiss Meditec Inc., Dublin, CA), investigators measured the rate of rod-mediated sensitivity recovery after exposure to 98% bleach. All patients had a pre-testing visual acuity of 20/25. Researchers also assessed each patient’s visual acuity and scotopic, contrast, and photopic sensitivities. The results of the study showed that, despite good visual acuity, patients with early AMD exhibited deficits in dark adaptation compared with the participants who had normal retinas.

**AMD AND UV LIGHT EXPOSURE**

Besides the potential impact of a yellow lens on scotopic sensitivity and color vision, some researchers have investigated the relationship between UV light exposure and the progression of early AMD. Recent evidence from large, population-based studies regarding the relationship between AMD and UV light exposure has been inconclusive.

The Pathologies Oculaires Liées à l’Âge (POLA) study examined the relationship between cataracts, AMD, and risk factors for the disease. More specifically, this population-based study investigated a lifetime of light exposure among 2,584 residents in a harbor town in southern France. Patients were classified based on color fundus photographs of their maculas. Of the participants examined, those exposed to high amounts of solar radiation both professionally and leisurely were found to have pigmentary abnormalities less frequently. Subjects who claimed to have used sunglasses when outdoors had a reduced risk for soft drusen. The POLA study concluded that the examination did not support “a deleterious
effect of sunlight exposure in AMD.”

The Beaver Dam Eye Study6 evaluated the association of sunlight with the 10-year incidence of AMD. Conducted in Beaver Dam, Wisconsin, data were collected on patients who were between the ages of 43 and 86 years. Residential history, time spent outdoors, and the use of hats and sunglasses were considered. Unlike the POLA study, this research showed an association between cumulative sun exposure and increased retinal pigmentation. However, investigators found that the use of hats and sunglasses did not prevent the progression of AMD at 10 years. The Beaver Eye Dam Study did not find a significant relationship between UV light exposure and the 10-year incidence and progression of AMD.

The Age-Related Eye Disease Study,7 a clinical trial sponsored by the National Eye Institute, reviewed the epidemiology responsible for causing AMD. According to this study, the consistent risk factors for AMD have been age and a family history of the condition. Furthermore, the review identified smoking, hypertension, and cataract surgery as associated causes of AMD. According to data from the Age-Related Eye Disease Study, threats for AMD do not include an exposure to UV-B light.

### BOTTOM LINE

Current IOLs that only block UV light are excellent at protecting the retina from potentially harmful light. Older patients with preexisting retinal disease would benefit from maximized scotopic vision. Adding chromophores to provide further photoprotection from blue light may be important, but that benefit must be balanced against any cost to patients’ functional vision.

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