

IOL light transmission properties should mimic 20-year-old crystalline lens

**Stefanie Petrou Binder MD
in Paris**

THE UV protection seen in the crystalline lens of a normal 20-year old should be the basis for the optimal design of pseudophakic IOLs, according to Jack T Holladay MD, PhD, Clinical Professor of Ophthalmology, Baylor College of Medicine, Houston, Texas, US.

"The natural transmission of the crystalline lens has become a hot topic in terms of intraocular lenses. It seems that the transmission properties of the 20-year-old crystalline lens are able to provide the eye with the maximum protection from harmful radiation," he told a session of the XXII Congress of the ESCRS.

Dr Holladay analysed absorbance data from published sources to determine the normal transmission of the human lens as a function of age (0, 20, 50, 70, 90 years) as compared to the transmission curves of blue-filtering, UV-blocking, and non-UV-blocking IOLs.

IOL transmission curves and age-dependent crystalline lens transmission curves were convolved with a standard daylight light source (K = 5500) to be able to equate the IOLs to the normal

crystalline lens at specific ages.

He found that the non-UV blocking IOLs transmit wavelengths as low as 320 nm. The UV-blocking IOLs cut off UV similar to the neonate, but allow substantially more blue, yellow, and green light than the natural lens.

Blue-blocker IOLs more similar to lenses of older eyes

He noted that one study on 'blue-blocker' IOLs revealed that the light transmission curves resulting from blue-blocking lenses were much like the 50-year-old crystalline lens for UV and blue light, blocking up to about 450 nm. They also allowed significantly more green and yellow light into the eye, more than would be seen in a child or neonate's crystalline lens.

Dr Holladay argued that blocking blue light (33% of light), reduces scotopic vision to that of a 50-year-old, making it more difficult to operate under mesopic and scotopic conditions.

Farnsworth-Munsell 100 and anomaloscope testing indicated that colour vision was best at age 19 years, and that it decreased almost linearly with age. These tests showed that blue-filtering intraocular lens curves were comparable to the 55-year-old

lens. The study revealed that about 20% of the loss in colour vision by the time we are 55 years is in the blue range, although the ageing crystalline lens may lose a bit of red/green perception as well.

Dr Holladay noted that blue filter lenses turn navy blue perception (about 400 - 450 nm) to black, much like what will happen to the crystalline lens by the time a person reaches the age of 55. Light blues, which range from 450 - 475 nm turn slightly into the aqua blue range. All other colours remain just about the same with a blue filter lens.

He said that these altered colour perceptions were smoothed over by the nervous system, which allow the eye to adapt. The eye can adapt, whether to halos after multifocal lens implantation or colour changes after cataract surgery, until you compare it by blocking out the 450 nm blue light, he said.

Dr Holladay explained that UV waves were less than 400 nm, and that the range between 286 - 320 nm was what was most damaging to our skin and the crystalline lens. UV blocking lenses, including the Acrysof Natural, Hoya IOL, and Medicon IOL, all block rays at about 400 nm, with the Acrysof lens blocking most, followed by the Hoya and then the Medicon

lenses.

He asserted that 'blue blockers' do not help in stopping the progression of age-related macular degeneration. In almost all of the 63 studies that he reviewed on the topic, conclusions were drawn without accounting for factors like drinking, smoking, antioxidants, genetics, or family history.

In fact, two of the studies even claimed the opposite to be true, that the more blue light that a person was exposed to throughout his life corresponded with a lower risk of macular degeneration (Rotterdam and New South Wales studies). He affirmed that contrary reports just prove that the blue-light theory is non-conclusive.

He noted that a study that involved monkeys that looked at the sun for three minutes showed more damage from blue light than from green light, as expected, since shorter wavelengths have higher energies per photon, Dr Holladay said.

He suggested that studies using maximal light and laser doses were not very valuable, as there would quite naturally be damage to the eye structures. Ultraviolet light is known to damage the skin and cause cortical cataracts but there is no evidence for increased AMD, he stressed.



Jack Holladay

"We feel that the UV and blue lenses are not beneficial enough. We should match the 20-year-old crystalline lens, at the time when the organs in our body are at their peak between 19-20 years, not the 55-year-old lens. Blue blockers present no threat or damage, but also no advantage. They definitely affect colour and scotopic vision, and as far as I can see, there is no use for them at this time."

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