

## Blue-blocking intraocular implants should be used routinely during phacoemulsification surgery – No

*Eye* (2012) 26, 1400–1401; doi:10.1038/eye.2012.177; published online 7 September 2012

Cataract surgery has changed significantly since the 1950s with the adoption of phacoemulsification. Along with phacoemulsification itself, intraocular lens (IOL) selection has also changed. We now have various options to choose from, ranging from aspheric to multifocal to toric IOLs. One such IOL is a yellow- or blue-blocking IOL that was developed to protect against retinal damage from light exposure of certain wavelengths and may as a result, prevent or slow progression of age-related macular degeneration (AMD).<sup>1</sup> Although the authors believe yellow IOLs have a role in the clinician's armament and should be considered in certain patients, we do not believe they should be used routinely.

A2E-laden lipofuscin is thought to be an initiator of blue-light induced apoptosis in retinal pigment epithelium leading to AMD progression. However, studies supporting this hypothesis have only been epidemiological or experimental, with no human trials to support this hypothesis. When we look at the evidence available as well, epidemiological evidence is conflicting, being supported by some studies<sup>2,3</sup> but not others.<sup>4,5</sup> In yet other epidemiological studies, AMD progression was observed following cataract surgery,<sup>6</sup> but an association between late AMD and severe cataract<sup>7</sup> has also been observed. Measuring light exposure over many years in epidemiological studies is difficult and confounding factors such as diet or geographical location may also have a role and affect the data obtained. Evidence from animal studies<sup>8</sup> also has to be considered cautiously, as they may not necessarily reflect a similar process in humans. As animals have a shorter

life span than humans, some studies were performed by using short bursts of high-intensity light, whereas it is thought that chronic light exposure on a day-to-day basis is more relevant to AMD progression in humans.<sup>1</sup>

There are also disadvantages to using yellow IOLs. An age-related decline in the number of rods is observed in the healthy eye resulting in a slowing of dark adaptation and reduced scotopic sensitivity. Experimental data has suggested that the use of a yellow IOL could reduce scotopic sensitivity by 14–25%.<sup>9–11</sup> It is therefore possible that using a yellow IOL could increase the risk of falls when an elderly patient is walking down stairs at night or affect a patient's ability to perform night-time activities such as driving.

Yellow IOLs are also thought to have the potential to disrupt the circadian rhythm. To maintain the circadian rhythm, biological and local time need to be synchronised and one of the most important environmental signals is the changing quality of light and dark.<sup>1</sup> It is thought that this is regulated by non-visual photoreceptors, the photoreceptive retinal ganglion cells that contain melanopsin, a photopigment with maximum sensitivity in the blue part of the visual spectrum. It has been suggested that yellow IOLs could potentially reduce melanopsin photoreception.<sup>1</sup> Many elderly patients who spend most of their time indoors due to poor mobility or other health co-morbidities may find having a yellow IOL implanted could affect their circadian rhythm further and this could affect mood and cognition and therefore the patient's quality of life.

In summary, the authors find it difficult to justify the use of blue-blocking IOLs in routine phacoemulsification surgery. This is because data supporting their use is based on

epidemiological studies that could be confounded by a number of different factors and evidence from animal studies has to be interpreted carefully, as they do not provide a true representation of what happens in humans from a biological perspective. There is also experimental evidence suggesting blue-blocking IOLs can affect scotopic sensitivity and a patient's circadian rhythm. This could affect their ability to drive at night, increase their risk of falls and affect their mood or cognition and subsequent quality of life.

Until more concrete evidence is in place, in a patient with bilateral asymmetrical AMD, the authors recommend that consideration should be given to implanting the yellow IOL in the eye with less severe disease to minimise AMD progression. The literature reports that most patients do not notice a problem with colour vision having a clear IOL in one eye and a yellow one in the other.<sup>12</sup> There is only one case report of a patient who required explantation of the yellow IOL due to colour perception problems.<sup>13</sup>

#### Conflict of interest

The authors declare no conflict of interest.

#### Acknowledgements

No funding was necessary for the production of this manuscript.

#### Disclaimer

None of the authors' academic institutions or employers has any financial or proprietary interest in the subject matter or materials discussed in this manuscript.

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