LETTER

Black intraocular lenses: near infra-red light transmission may risk treatment failure

Intractable diplopia occurs in approximately 0.8% of patients following strabismus surgery, with considerable detriment to visual quality of life. Long-term therapeutic occlusion is required to permit functional vision.

Black intraocular lens (IOL) implantation is an effective therapeutic option associated with high rates of postoperative satisfaction. Black IOL implantation entails a cost to the public sector or patient but this may be offset by long-term clinical and social benefits and fewer hospital visits.

A distinction has emerged between black IOLs that transmit near-infrared (NIR) light and those producing total occlusion of all wavelengths of light (figure 1).2 Morcher black IOLs transmit NIR light exponentially from 720 nm, with 100% transmission over 820 nm, permitting posterior segment imaging with scanning laser ophthalmoscopy (SLO) and optical coherence tomography (OCT).2 This property offers a distinct clinical advantage; SLO/OCT may detect life-threatening retinal and optic nerve diseases, such as choroidal melanoma.2

The intended benefit of black IOL implantation is occlusion of light. Enigmatic perception of light across NIR-transmitting black IOLs has been reported widely without any consensus on the mechanism of light perception.1 3–5 Four hypotheses have been suggested: (1) Perception of light by long-wavelength, L-cone photoreceptors due to NIR light transmission across Morcher black IOLs2 5 (2) Para-optical light leakage in patients with large scotopic pupil diameters,4 (3) Light transmission across the intact sclerochoroidal tunic,4 (4) Non-organic light perception.

Retrospective examination of all black IOL case series reported in the literature (table 1) strongly supports the hypothesis that black IOLs act as occluding lenses.

Figure 1 Black IOLs in clinical use. Near-infrared (NIR)-transmitting black IOLs: (A) 85F PMMA IOL (6 mm optic, 12 mm overall), (B) 65 PMMA IOL (10 mm optic, 12 mm overall), (C) 80D PMMA IOL (6 mm optic, 13.5 mm overall). All NIR-transmitting Black Lotus 80D PMMA IOL are manufactured by Morcher GmbH, Stuttgart, Germany. Non NIR-transmitting black IOLs: (D) Artisan Black iris-claw IOL (201, polycarbonate, 5.4 mm optic, 8.5 mm overall, manufactured by Ophtec BV, Groningen, Netherlands), (E) Black PMMA IOL (612, 6 mm optic, 12 mm overall, manufactured by Dr Schmidt Intraocularlinsen, Sankt Augustin, Germany).
of NIR light perception across NIR-transmitting black IOLs as the primary mechanism underlying treatment failure—defined as troublesome persistence of light perception or diplopia despite black IOL implantation.

Twenty-three patients have been reported across four case series, which document preoperative and postoperative visual acuities of patients implanted with NIR-transmitting black IOLs4–6 (table 1). Twenty-one patients (91%) recorded light perception vision through the black IOL postoperatively.

Two patients experienced complete occlusion of light after NIR-transmitting black IOL implantation; both patients had optic neuropathies documented preoperatively (compressive and demyelinating, respectively). Optic neuropathies are associated with loss of red-green chromatic discrimination due to effects on parvocellular pathways representing long-wavelength cone photoreceptors; such patients are unlikely to perceive long-wavelength NIR light.

Clinical observations further discount the alternative hypotheses of light perception following black IOL implantation; both patients had optic neuropathies documented preoperatively (compressive and demyelinating, respectively). Optic neuropathies are associated with loss of red-green chromatic discrimination due to effects on parvocellular pathways representing long-wavelength cone photoreceptors; such patients are unlikely to perceive long-wavelength NIR light.

We have experience of a patient with chronic, debilitating light perception despite implantation of an NIR-transmitting black IOL, who underwent secondary implantation of a NIR-blocking Artisan iris-claw IOL (figure 1D) fixed over the pupillary margin with enclavation. This patient recorded no light perception postoperatively, discounting the hypothesis of light penetrating the intact sclerochoroidal tunic (Yusuf et al, unpublished). There is no evidence for a non-organic aetiology as a basis for light perception in these case series.
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Imran H Yusuf, Stuart N Peirson and C K Patel

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