Pigmentary dispersion syndrome with a secondary piggyback 3-piece hydrophobic acrylic lens

Case report with clinicopathological correlation

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We describe a case of pigmentary dispersion syndrome resulting from secondary piggyback implantation of a 3-piece hydrophobic acrylic squared-edged intraocular lens (IOL) in the ciliary sulcus. The intraocular pressure remained elevated despite pharmacological treatment, with a heavily pigmented trabecular meshwork. The piggyback IOL was subsequently explanted and replaced by a silicone IOL with smooth round edges. Examination of the explanted IOL under light and scanning electron microscopy showed clusters of pigment epithelial cells located around the periphery of the anterior optic surface.

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There is a renewed interest in the piggyback procedure, not only for correction of residual refractive errors, but also because of the potential to implant a low-power multifocal intraocular lens (IOL) to provide spectacle freedom to pseudophakic patients. One problem noted with the initial piggyback implantation of IOLs was the formation of interlenticular opacification (ILO).[1–3] Several methods to prevent ILO including a relatively large capsulorhexis and implantation of the piggyback IOL in the ciliary sulcus rather than the capsular bag have been shown to decrease the incidence of this complication. However, implantation of a piggyback IOL in the ciliary sulcus may be associated with a different set of problems, such as the pigmentary dispersion syndrome.

We describe the development of pigmentary dispersion syndrome with a secondary piggyback, 3-piece hydrophobic acrylic IOL (AcrySof, model MA60MA, Alcon Laboratories) placed in the ciliary sulcus. To our knowledge, this is the first time the clinicopathological correlation in such a case has been provided. The case illustrates that some IOL design features may be inappropriate for piggyback sulcus implantation.

CASE REPORT

A 66-year-old man presented with high myopia; the spherical equivalent was around −20.0 diopters (D) in both eyes. The axial length, measured by the IOLMaster (Carl Zeiss Meditec), was 28.83 mm and 28.52 mm in the right eye and left eye, respectively. No posterior staphyloma was noted on B-scan ultrasonography, but the patient had very steep corneas; the topography was consistent with keratoconus, most notably in the left eye.

Cataract surgery was performed in the right eye on May 12, 2005, with in-the-bag implantation of a −4.0 D MA60MA IOL, and in the left eye on June 2, 2005, with in-the-bag implantation of a −9.0 D AR40M IOL (Advanced Medical Optics). Both procedures were uneventful.

One day postoperatively, the uncorrected visual acuity (UCVA) in the left eye was 20/400, 20/200 with pinhole,

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due to myopic macular degeneration. The residual refraction was +3.50 +1.50 × 70 (20/100). An IOL exchange was discussed with the patient and a follow-up visit scheduled for June 6, 2005, at which point the UCVA in the left eye was 20/200 with no improvement with pinhole; the refraction was +3.50 +1.50 × 70 (20/80). An IOL exchange was attempted on June 14, 2005, 12 days postoperatively, but the IOL was firmly attached to the capsular bag. A piggyback +5.0 D MA60MA IOL D was therefore placed in the ciliary sulcus, with no further complications during the surgery. One day after the exchange, the UCVA was 20/200, with no improvement on pinhole; the residual refraction was −1.00 +1.25 × 110. The IOP was 12 mm Hg.

Five weeks postoperatively, the patient complained of a decrease in visual acuity in the left eye, with difficulty reading and driving and inadequate depth perception. The UCVA was 20/400 with no improvement with pinhole. The IOP was 42 mm Hg, with a heavily pigmented trabecular meshwork. Pigmentary dispersion syndrome was diagnosed, and medical treatment was initiated with topical atropine 1%, dorzolamide 2%, timolol 0.5%, brimonidine 0.2%, and ketorolac 0.5%. By week 12, with continued medical treatment, the IOP in the left eye had stabilized to within normal limits, but iris atrophy had developed. On September 22, 2005, the sulcus IOL was removed and replaced with an AQ5010V IOL (Staar Surgical). Postoperatively, the circulating pigment in the anterior chamber cleared, but the patient required aqueous suppressants for IOP control.

The patient was last seen on August 21, 2006. Two weeks after the medication in the left eye was stopped, the IOP was 16 mm Hg and 17 mm Hg in the right eye and left eye, respectively. The best corrected visual acuity was 20/125 (right eye) and 20/200 (left eye), again mainly due to myopic macular degeneration.

Laboratory Analysis

The explanted IOL, which had been bisected for explantation, was sent to the John A. Moran Eye Center, University of Utah, in the dry state. Gross examination of the explanted IOL was performed, and gross pictures were taken using a Nikon camera (Model D1x with a Nikon ED 28-70 mm AF lens). The unstained IOL was then microscopically evaluated and photographed under a light microscope (Olympus, Optical Co. Ltd.). The IOL was also sent to D. Zhao, PhD (Electron Microscopy Center, University of South Carolina, Columbia). It was air dried at room temperature for at least 3 days, mounted uncoated on a carbon sticky tape on a round sample stub for imaging, and analyzed using an environmental scanning electron microscope (SEM) (FEI Quanta 2000 ESEM). The anterior surface of the lens as well as the lateral edges were analyzed with this technique.

Gross and microscopic analyses of the explanted IOL revealed the presence of significant amounts of pigment, as well as iris-pigmented epithelial cells (Figures 1 and 2). These were located primarily on the periphery of the optic and on the anterior surface of the IOL; they were observed in clusters for 360 degrees around the optic.

Pigment and iris pigmented epithelial cells on the anterior IOL surface were also analyzed using SEM (Figure 3). This technique showed the relatively thick and unpolished side walls of this IOL design, as well as the rough, square edge at the junction between the lateral edge and the anterior optic surface.

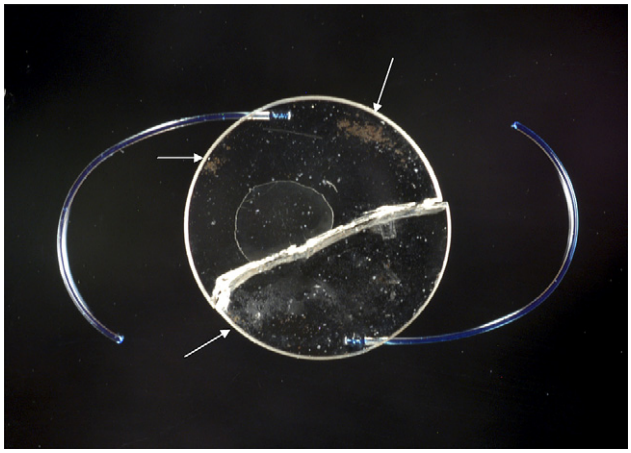

Figure 1. Gross photograph of the anterior surface of the explanted IOL. The arrows show the clusters of pigment and pigmented epithelial cells.

DISCUSSION

The finishing of the square edges of AcrySof IOLs was modified to give the side walls an unpolished or textured appearance, which improved glare phenomena.[4] This was extended along the length of the optic and haptics in the single-piece designs. Because of the flexibility and thickness of the haptics, the square optic and haptic edges, and the unpolished side walls, implantation of the single-piece AcrySof IOL in the sulcus is not advisable and is not indicated for sulcus fixation in the "Directions for Use" labeling. We recently reported 3 single-piece AcrySof IOLs that were explanted because of pigmentary dispersion syndrome related to the presence of their haptics in the ciliary sulcus.[5] These cases revealed the presence of significant amounts of iris pigment on the anterior surface of the IOL (optics and haptics). Similar cases of pigmentary dispersion have been described with this IOL.[6]

The MA60MA AcrySof is the 3-piece design with low dioptric powers (ranging from −5.0 to +5.0 D). The edge of the MA60MA is 0.5 mm compared with 0.3 mm for the MA60AC (Alcon Laboratories, personal communication, April 2006). It is likely that the thick textured square edges of the secondary IOL led to the complications described. A review of the peer-reviewed literature suggests it is more appropriate to use IOLs with smooth rounded optic edges, especially th anterior optic edge and especially when implanted in the sulcus in a piggyback configuration.[4–8]

Wintle and Austin[7] report a case of pigmentary dispersion syndrome 1 month after implantation of a 3-piece hydrophobic acrylic IOL (AcrySof model MA60BM, 6.0 mm optic, 13.0 mm overall length) placed electively in the ciliary sulcus following

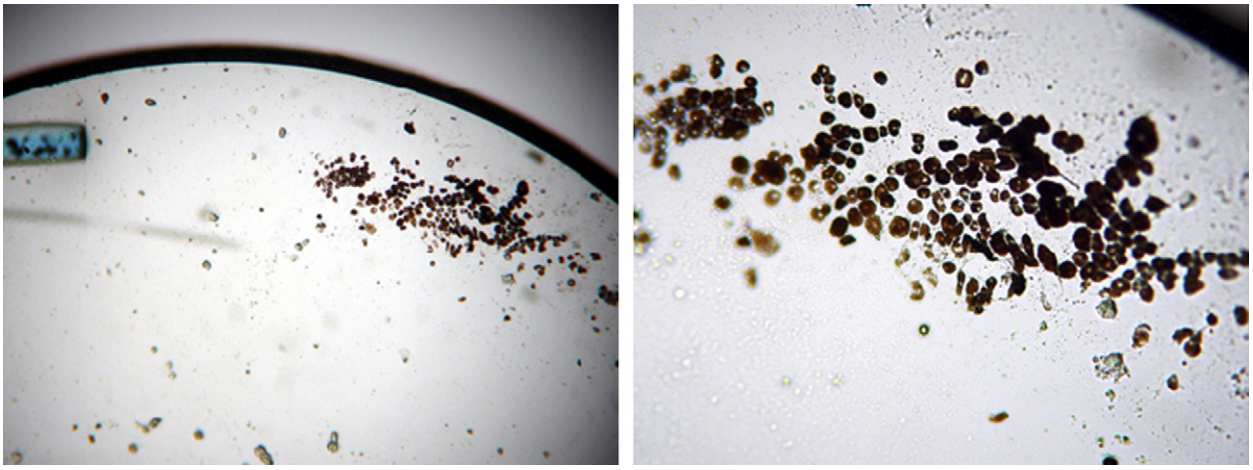

Figure 2. Light photomicrographs show the presence of pigment and pigmented epithelial cells on the periphery of the anterior optic surface of the square-edged IOL that was implanted in the sulcus in a piggyback configuration. *Left*: Original magnification ×100. *Right*: Original magnification ×200.

a posterior capsule tear. In this patient, IOP control was achieved pharmacologically, with eventual discontinuation of treatment and stabilization of the IOP after 6 months of therapy, although hyperpigmentation of the trabecular meshwork continued. Chang and Lim[8] and Iwase and Tanaka[9] describe cases of pigmentary dispersion syndrome with 3-piece AcrySof IOLs implanted in a piggyback configuration. Our case confirms their findings and provides the clinicopathological correlation of the explanted IOL.

In our patient, the Staar AQ5010V IOL replaced the original square-edged IOL placed in the sulcus. This is a low power, 3-piece IOL with a cast-molded silicone optic (6.3 mm in diameter), modified C-loop polyimide haptics, and a posterior optic–haptic angulation of 10 degrees (14.0 mm in overall diameter). The optic design changes from convex/plano (+1.0 to +4.0 D) to plano/plano (0 D) and to plano/concave (−1.0 to −4.0 D), progressing down the diopter range. The optic edges are smooth, which may prevent iris chafing with subsequent pigment dispersion and increased

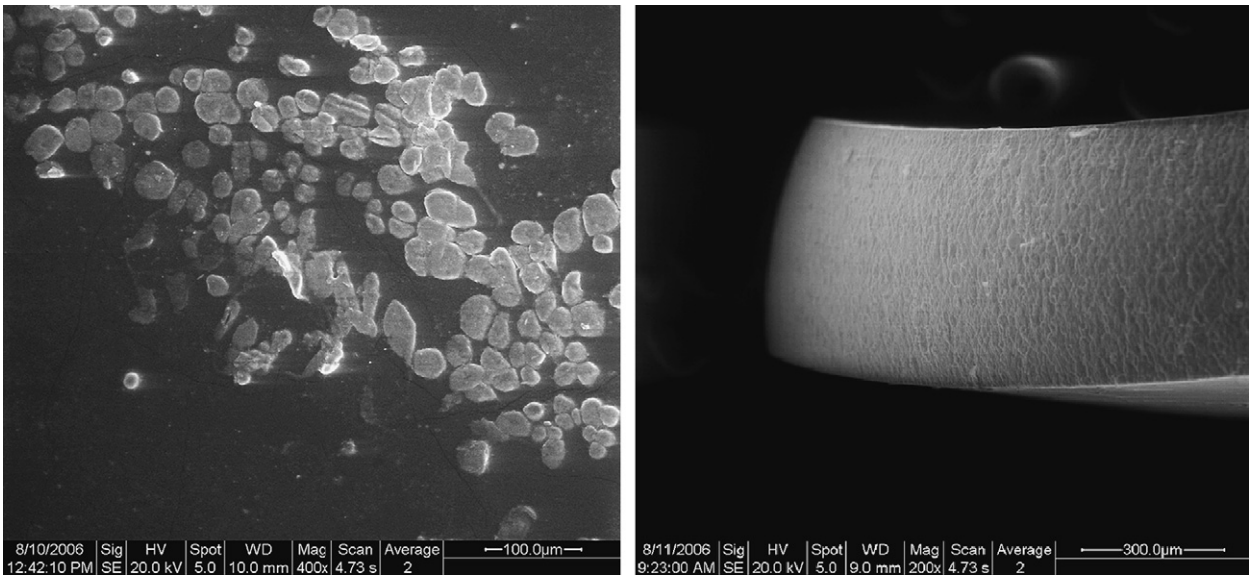

Figure 3. Scanning electron photomicrographs obtained from the explanted IOL. *Left*: Anterior view showing a cluster of iris pigmented cells on the anterior IOL surface. *Right*: Lateral view showing the square textured optic edge of the IOL.

IOP, as described in our patient as well as in the other reports.

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