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Retinal Pigment Deposition Secondary to Iatrogenic Pigment Dispersion

Megan A. Rowlands, MD, MPH¹, Talia R. Kaden, MD^{1,2,3}, Michael J. Weiss, MD⁴, Vaidehi S. Dedania, MD¹, Gregory D. Lee, MD¹, Joel S. Schuman, MD¹, Ilyse D. Haberman, MD¹, William M. Schiff, MD², Yasha S. Modi, MD¹

¹Department of Ophthalmology, New York University School of Medicine, New York, NY

²Department of Ophthalmology, Manhattan Eye Ear and Throat Hospital, New York, NY

³Vitreous Retina Macula Consultants of New York, New York, NY

⁴Edward S. Harkness Eye Institute, New York Presbyterian Hospital, New York, NY

Pigment dispersion syndrome (PDS) affects 2.5% of the United States population and accounts for 1% to 1.5% of patients with glaucoma.¹ Iatrogenic PDS, often secondary to intraocular lens (IOL) implantation or ocular trauma, results from direct mechanical degradation of the iris stroma causing pigment release, which flows via aqueous currents onto anterior segment structures.^{1–3} This pigment is phagocytosed by endothelial cells of the cornea and trabecular meshwork and may lead to trabecular meshwork obstruction, intraocular pressure (IOP) elevation, and pigmentary glaucoma.¹ Pigment has also been detected on the anterior and posterior surfaces of the lens and the anterior hyaloid.^{1,2} We describe 4 eyes in 3 patients with retinal pigment deposition after iatrogenic pigment dispersion. In accordance with our institution's guidelines, this work was exempt from institutional review board approval.

An 85-year-old woman was evaluated for spots on her retina and a gradual decrease in vision in her right eye. She was pseudophakic, with the right cataract extraction (CE)

Correspondence: Yasha S. Modi, MD, Department of Ophthalmology, New York University, 222 East 41st Street, 3rd Floor, New York, NY 10017. Yasha.modi@gmail.com.

Author Contributions:

Conception and design: Rowlands, Kaden, Weiss, Dedania, Lee, Schuman, Haberman, Schiff, Modi

Analysis and interpretation: Rowlands, Kaden, Weiss, Dedania, Lee, Schuman, Haberman, Schiff, Modi

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HUMAN SUBJECTS: Human subjects were included in this study. In accordance with New York University School of Medicine's Institutional Review Board guidelines, this work did not require IRB review or approval. All research adhered to the tenets of the Declaration of Helsinki. All participants provided written, informed consent.

No animal subjects were used in this study.

complicated by significant iris trauma. She also had undergone a pars plana vitrectomy (PPV) and placement of a glaucoma drainage implant in the right eye a few years earlier. On examination, best-corrected visual acuities were 20/150 in the right eye and 20/20 in the left eye. Anterior examination of the right eye revealed a superior corneal wound consistent with an extracapsular CE, corneal sutures, and a partially subluxed 1-piece polymethyl methacrylate lens, with the nasal haptic anterior to the capsule. The iris was macerated with iridoschisis. Extensive pigment was present on the corneal endothelium, lens, anterior capsule, and residual postvitrectomy anterior hyaloid (Fig 1A). Funduscopy examination of the right eye demonstrated the absence of vitreous and dense pigment overlying the macula, optic nerve, and inferior retina (Fig 1B). OCT examination revealed a dense hyperreflective layer anterior to the internal limiting membrane (ILM; Fig 1C) corresponding to this pigment. The left eye was unremarkable.

A 53-year-old woman with a remote history of a left CE complicated by IOL subluxation sought evaluation of a cataract in the right eye. After undergoing right CE, complicated by a capsular tear requiring anterior vitrectomy and a 3-piece sulcus IOL implantation, her postoperative course was complicated by persistent cystoid macular edema and uveitis—glaucoma—hyphema syndrome. At postoperative month 4, her vision in the right eye was 20/50, the IOP was 11 mmHg, and examination revealed pigment on the IOL, in the anterior vitreous, and along the inferior macula (Fig 1D). There was a posterior vitreous detachment on examination. This pigment appeared hypofluorescent on fundus autofluorescence (Fig 1E). OCT revealed hyperreflective deposits anterior to the ILM (Fig 1F). Given the cystoid macular edema and recurrent inflammation, she underwent PPV, IOL removal, and placement of a scleral-sutured IOL. Two months after surgery, the cystoid macular edema had resolved, and vision was 20/30.

Concurrently, she developed a uveitis—glaucoma—hyphema syndrome resulting from the 1-piece subluxed IOL in the left eye, and she underwent a lens exchange with placement of a scleral-sutured Akreos lens (Bausch and Lomb, Rochester, NY) and complete PPV. Eight months later, vision in the left eye was 20/20 and IOP was 30 mmHg. She showed 4+ pigment on gonioscopy, pigment on the IOL, and subtle pigment in the inferior macula and periphery (Fig 1G). Fundus autofluorescence showed hypofluorescent deposits (Fig 1H), and OCT revealed hyperreflective deposits on top of the ILM (Fig 1I).

A 59-year-old man was evaluated for a traumatically subluxed native lens, vitreous prolapse, and ocular hypertension in the left eye after a fall. His vision was 20/40, and IOP was 42 mmHg. Five days later, he underwent a PPV, lensectomy, and placement of a scleral-sutured IOL, which was complicated during surgery by floppy iris and iris prolapse through the paracentesis requiring iris hooks and repositioning with a cyclodialysis spatula. At postoperative month 3, best-corrected visual acuity was 20/40 and IOP was 18 mmHg. His examination was notable for iris atrophy, iri-dodonesis, and multiple iris transillumination defects (Fig S2A, available at www.ophtalmologyretina.org), as well as pigment on the corneal endothelium, anterior IOL, and a few pigment granules on the optic nerve and inferior macula. OCT revealed small hyperreflective deposits on top of the ILM corresponding to this pigment (Fig S2B, D).

We describe 3 patients who manifest features of posterior pigment dispersion that is unique to the iatrogenic pigment dispersion scenario. The literature has described extensively pigment migration onto the posterior capsule of the lens, but typically no farther.¹⁻⁴ This finding of pigment on only the posterior capsule or anterior hyaloid has been attributed to Wieger's ligament and Berger's space, which provide anatomic barriers preventing retrolental diffusion of pigment.^{1,2} Few PDS cases describe associated retinal pigmentary changes,^{1,4,5} but these cases do not demonstrate pigment dispersion onto the retina after iatrogenic trauma.

The definitive mechanism of posterior pigment deposition remains unknown, but can be conjectured based on the ocular histories. All eyes underwent CE complicated by iris trauma, with malpositioned IOL haptics yielding persistent iris chafing and pigment release. Additionally, all eyes had disrupted anterior hyaloid faces and separation (or absence) of the posterior hyaloid. Given the disruption of these hyaloid faces that presumably would serve as a barrier, we hypothesize that pigment may flow unimpeded to the posterior pole and settle on the ILM.

The degree of iris trauma and pigment dispersion in patient 1 was severe, with pigment coated confluent over the macula corresponding to a reduction in best-corrected visual acuity. Additionally, patient 1 had a glaucoma drainage implant placed in the pars plana, facilitating posterior aqueous and pigment flow in the postvitrectomy state, which likely exacerbated the posterior pigment deposition. Patients 2 and 3 showed milder presentations with only a few pigment granules seen. This may be related to the short duration of iatrogenic dispersion or may represent a subtle finding that easily could be overlooked in a patient with iatrogenic PDS with posterior vitreous detachment or after vitrectomy.

In our patients, the pigment settled predominantly along the inferior macula and periphery, suggesting a gravitational effect. Additionally, the pigment remained fixed, which may indicate that the pigment was phagocytosed by inner retinal cells, similarly to how pigment is ingested by anterior segment endothelial cells and macrophages, or that it had been incorporated into the ILM. In summary, we describe 4 eyes in 3 patients with posterior pigment deposition onto the inner surface of the retina after complicated cataract extractions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Abbreviations:

CE	cataract extractions
ILM	internal limiting membrane
IOL	intraocular lens
IOP	intraocular pressure
PDS	pigment dispersion syndrome

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Figure 1.

A, Color photograph of the anterior segment in the right eye of patient 1 demonstrating the extensive pigment deposition on the corneal endothelium, lens, anterior capsule, and residual anterior hyaloid. **B**, Color photograph of the right fundus showing dense preretinal pigment overlying the macula on the optic nerve and surrounding the disc. **C**, Horizontal OCT image through the right macula revealing a dense hyperreflective layer anterior to the internal limiting membrane (ILM) corresponding to the retinal pigment. **D**, **G**, Color photographs of the (**D**) right and (**G**) left eyes of patient 2 revealing multiple subtle deposits (seen in higher-magnification insets) of preretinal pigment in the inferior peripheral retina and inferior macula. **E**, **H**, On fundus autofluorescence, these areas of pigment appeared hypoautofluorescent. **F**, **I**, OCT image through these areas revealing small hyperreflective deposits resting on top of the ILM.