Management of Pigment Dispersion Syndrome in a Young Adult Patient:

A Case Report

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Abstract:

Purpose: Discuss the management of pigment dispersion syndrome (PDS); discuss the etiology, pathophysiology of PDS, and the risk of conversion into pigmentary glaucoma.

Case: A 24YO Caucasian male presented to the University Eye Center for an annual eye exam and to monitor his pigment dispersion syndrome which had been diagnosed approximately one year prior. All entrance testing was unremarkable and the patient's vision was correctable to 20/15-1. Examination of the anterior segment revealed pigmented cells adhered to the posterior corneal endothelium (Krukenberg's spindles) and iris transillumination defects OU. Gonioscopy was performed and revealed a slightly concave iris approach and a wide-open angle with moderate to heavy pigment deposition in the posterior TM in all views. IOP was measured via Goldmann applanation tonometry (GAT) and found to be 20mmHG OD, and 21mmHG OS. Dilated posterior segment exam showed all normal findings, with no signs of glaucomatous changes in either eye. An optic nerve OCT was taken to establish baseline values. A Zeiss FDT was done for screening purposes and detected zero visual field defects. The patient was instructed to return to the clinic for continued monitoring in one year, or sooner if any symptoms arise.

Conclusion: Pigment dispersion syndrome (PDS) requires regular examination to monitor for potential development of pigmentary glaucoma (PG). Exam elements that should be done at every visit include gonioscopy, IOP measurement, and examination of the optic nerve. Visual field testing and ON and macular OCT should also be done annually, or more frequently if indicated by risk factors or clinical signs. This paper highlights the etiology and pathophysiology of PDS and discusses the risk of developing secondary glaucoma, specifically PG.

***Key Words*:** Pigment Dispersion Syndrome (PDS), secondary glaucoma, pigmentary glaucoma, concave iris, reverse pupillary block, iris transillumination defects (TID).

Introduction

Pigment Dispersion Syndrome (PDS) is a condition characterized by iris pigment shedding. This liberated pigment collects in the posterior trabecular meshwork and on the corneal endothelium. PDS is thought to be caused by friction between the posterior iris and the zonules of the lens. Patients with PDS tend to have myopia and a relatively deep AC, which favor the backward bowing of the iris towards the lens. Pigment collection in the TM can impair aqueous drainage out the of the eye, leading to increased IOP. This increased IOP can lead to a type of secondary glaucoma called pigmentary glaucoma. This condition is generally bilateral, although may be asymmetric between eyes.

Case Report:

A 24YO Caucasian male presented to the University Eye Center at the Michigan College of Optometry for an annual eye exam and to monitor his pigment dispersion syndrome which had been diagnosed one year prior by an outside provider.

The patient was not taking any medications, had no known drug allergies, and his personal and family medical history were unremarkable. The patient's pupils were equally round, reactive to light with no relative afferent pupillary defect (RAPD). Entering aided distance visual acuities were 20/20+1 in both eyes individually and together. Entering aided near acuities were 20/15. All other entrance testing was unremarkable and the patient's vision was correctable to 20/15 distance and near with only a small change in his refraction from the habitual prescription. The patient was a current contact lens wearer of Acuvue Oasys with HydraLuxe daily disposable lenses. The following glasses prescription was finalized and released: (OD) -4.00-0.50 x 024; (OS) -4.00 -0.50 x 180.

Anterior segment examination showed heathy eyelids and lashes, flat and intact brown irids, and white and quiet conjunctiva. In both eyes, retroillumination of the cornea revealed pigmented cells adhered to the posterior corneal endothelium – called Krukenberg's spindles (Figure 1). Mid-peripheral iris transillumination defects were also found in both eyes (Figure 2). The Van Herick estimation technique showed a grade 4 wide-open angle. Four mirror gonioscopy was then performed and revealed a slightly concave iris approach and a wide-open angle with dense pigment deposition in the trabecular meshwork (TM) in all four quadrants of both eyes. Heavier pigmentation was found in the left eye. Angle pigmentation was densest inferiorly (Figure 3 & 4). The examination was negative for neovascularization, iris recession, or pseudo-exfoliative material. IOP was measured via GAT and found to be 20mmHG OD, and

21mmHG OS. Next, a Zeiss Humphrey FDT C-20 screening visual field was conducted which detected zero visual field defects.

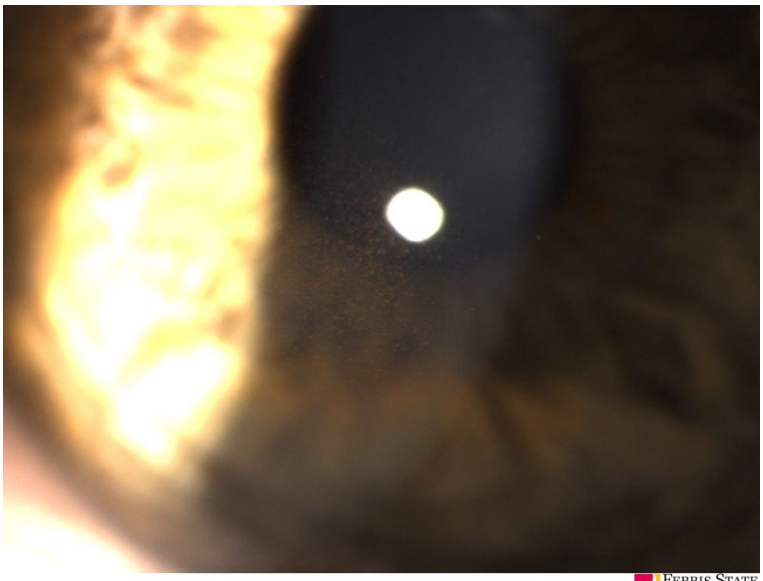

Figure 1: **Krukenberg Spindle OS (similar finding in other eye)**

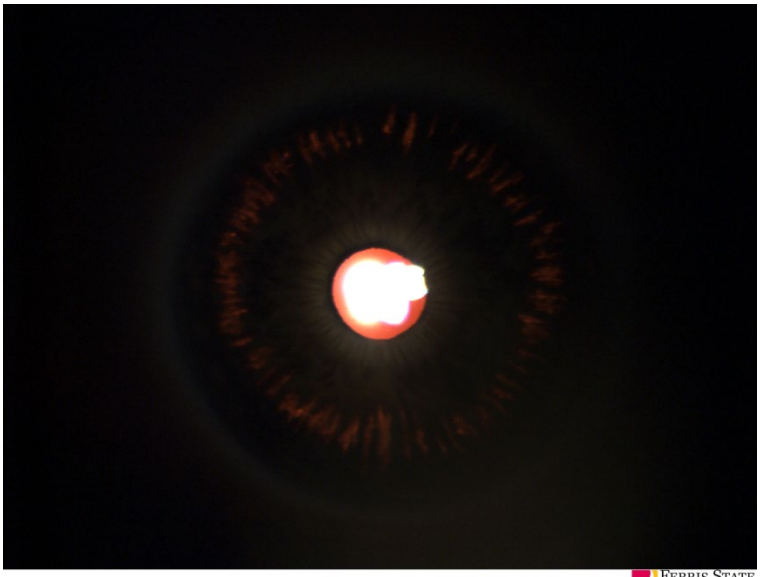

Figure 2: **Iris TID OS (similar finding in other eye)**

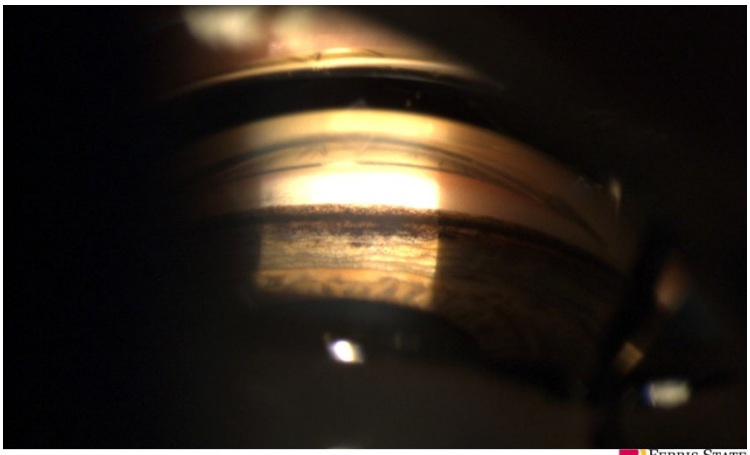

Figure 3: **Inferior angle OS**

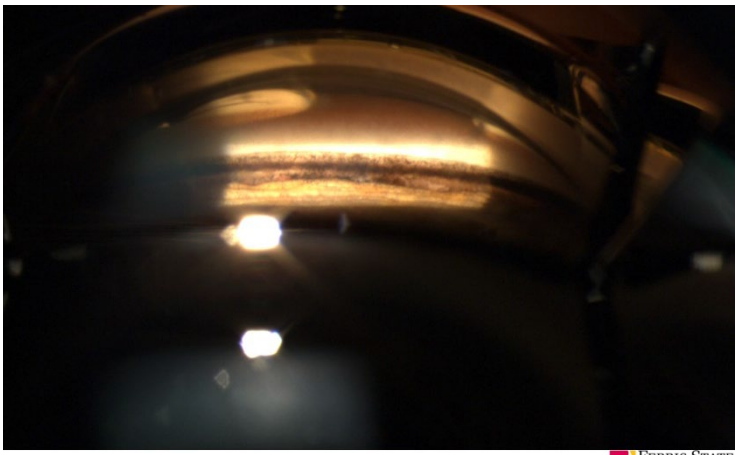

Figure 4: **Inferior angle OD**

The patient was dilated with tropicamide 1% and a fundoscopic and BIO examination was performed. The posterior pole examination revealed obliquely inserted optic nerve heads with distinct margins and perfused coloration OU. There were no disc hemes or notches in either eye. Rim tissue of both optic nerves followed the “INST rule”. The OD C/D ratio was estimated to be 0.45 round; the OS C/D ratio was also 0.45 round. Normal retinal vessel course

and caliber was observed, along with absence of macular edema and retinal holes, breaks, or tears. Finally, a combined macular and ON OCT was taken of both eyes (TopCon Maestro 2 – 3D Wide) (Figure 5). OCT showed a normal macular ganglion cell layer (GCL) and thickness map in both eyes. The OCT report also showed normal thickness and profile of the circumpapillary retinal nerve fiber layer (cpRNFL) in both eyes with only one exception – the 12:00 clock hour of the right eye was flagged as borderline thin with a thickness of 76. The average rim area, cpRNFL thickness, and GCL thickness were all well within normal age-matched values.

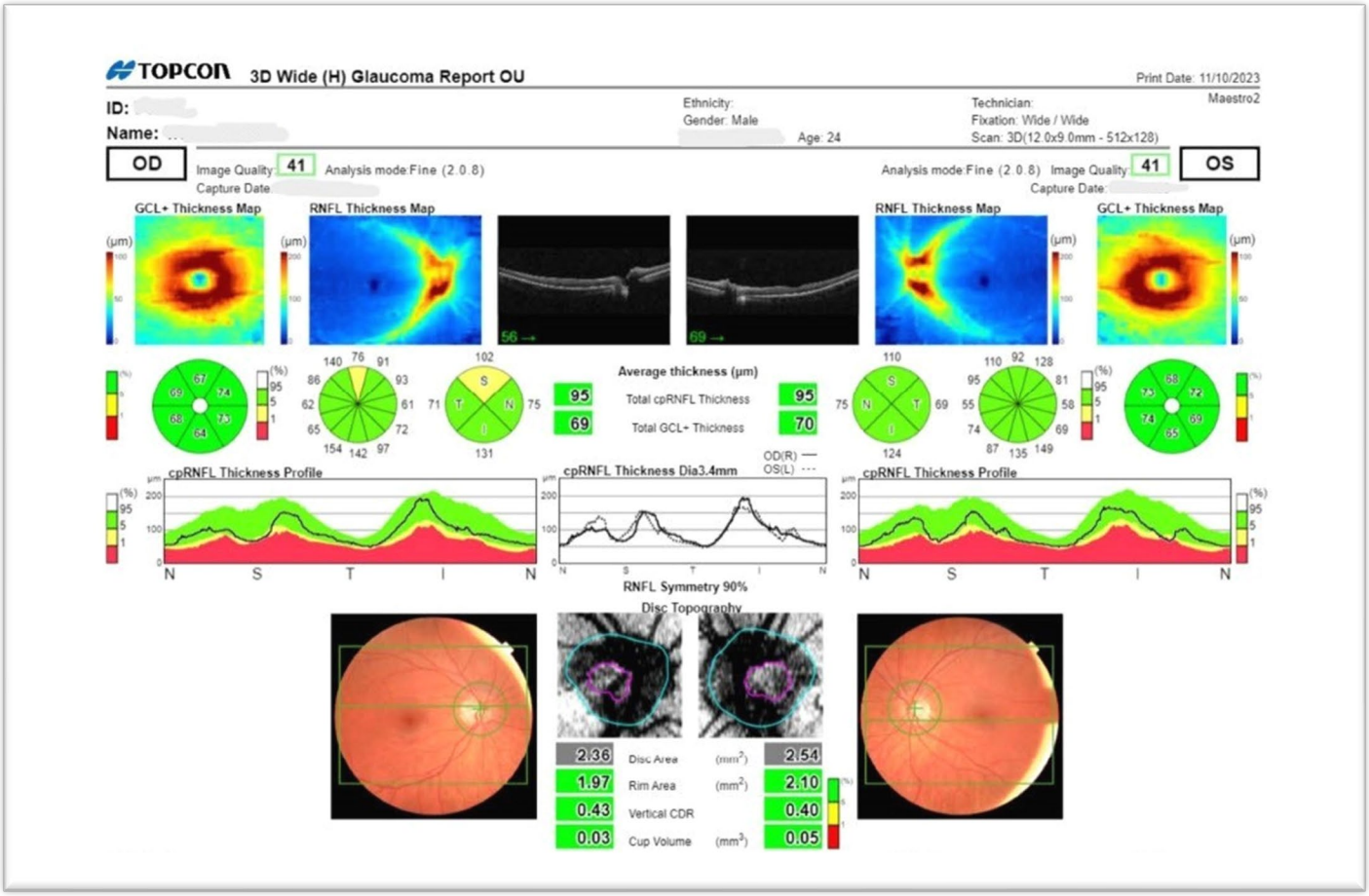

Figure 5: **Combined optic nerve and macula/GCL OCT report - OU**

After considering the totality of the clinical signs and data, we determined that our 24yo male patient had no signs of glaucomatous changes and was currently at low risk for developing pigmentary glaucoma secondary to his PDS. We educated the patient on the status of his condition and explained the underlying pathophysiology of PDS. We educated the patient that PDS is a bilateral, chronic condition which warrants yearly monitoring at a minimum. The

patient was also informed that we may require him to be seen more frequently in the future if indicated by any additional risk factors that may arise over time (increased age, IOP greater than 21, signs of glaucomatous changes). The patient was advised to return to the clinic in one year for a full exam including repeating gonioscopy, VF testing (24-2 sita-fast), and OCT.

Discussion

Epidemiology: The prevalence of pigment dispersion syndrome (PDS) is approximately 2% to 4% in the general American population, with lower incidence in African Americans and Asians compared to whites.[1] Most people with PDS are myopic. Some studies have shown a higher prevalence of PDS in males compared to females, but some newer studies have not replicated this.[2] PDS can be inherited as an autosomal dominant trait, which suggests that specific genes may be responsible. A locus for this syndrome has been found on chromosome 7q35-q36, but the responsible gene(s) are still unknown.[3] Risk factors associated with PDS are: myopia, posterior iris insertion and/or concave iris configuration, and family history of PDS.[2]

According to the literature, the lifetime chances of developing pigmentary glaucoma (PG) from PDS are between 25 and 50%.[4] It is proven that males with PDS have a higher risk of developing pigmentary glaucoma (PG) compared to females with PDS.[4]

Pathophysiology: The pigment shedding seen in PDS is caused by rubbing of the posterior pigment layer of the iris against the lens zonules, likely due to excessive posterior bowing of the mid-peripheral iris. Reverse pupillary block can occur due to posterior iris insertion causing iridolenticular contact. Actions such as blinking, accommodation, and exercise have been reported to exacerbate the reverse pupillary block mechanism and cause acute increases in pigment release. Short term IOP elevation can occur due to direct trabecular meshwork (TM) obstruction by released melanin granules.[5] Chronic IOP elevation is thought to be caused by obstruction and damage of the intertrabecular spaces from pigment laden macrophages. Interestingly, pigment dispersion decreases after middle age – roughly after the age of 50. This so-called “burn out phase” occurs due to less production of replacement pigment, probably from decreased mitotic activity, and less iridolenticular contact due to less physiological accommodation after middle age.[5]

Clinical signs: The classic presentation of PDS includes pigment visible in the AC, Krukenberg spindles, mid-peripheral iris transillumination defects, and increased pigmentation in the TM visible on gonioscopy. Pigment may also collect on the anterior lens or posteriorly near the origin of the zonules. PDS is almost always bilateral. Signs of PG include highly elevated IOP

(a mean IOP of 29 mmHg at diagnosis), glaucomatous changes to the optic nerve, and visual field loss.[3]

Symptoms: PDS/PG is generally asymptomatic. Occasionally, patients may notice that exercise or pupil dilation can cause a spike in pigment release with acute elevation of IOP causing symptoms of halos around lights and blurred vision.

Differential Diagnoses: There are several conditions with clinical signs similar to PDS. Pseudo-exfoliation syndrome (PEX) can be present with iris transillumination defects (TID), TM pigmentation and elevated IOP. However, iris TID in PEX tends to occur at the pupillary margin rather than in the mid-peripheral iris. The pigmentation seen in PEX is much lighter in color and more flaky and patchy in comparison to PDS. PEX is almost always unilateral, and in much older patients (> 60), compared to PDS which is usually bilateral and initially diagnosed between ages 20 and 40.

Anterior uveitis can cause release of inflammatory cells and debris into the anterior chamber, which can be mistaken for PDS. Herpetic anterior uveitis is a common cause of iris TID defects associated with elevated IOP. Additionally, uveitis can cause patchy increased TM pigmentation. However, uveitis will be accompanied by other symptoms not seen in PDS such as pain, photophobia, reduced vision, circumlimbal injection, posterior synechiae, and keratic precipitates on the cornea.

Treatment of PDS: The management protocol of PDS is similar to that of OHT: annual eye exams with IOP checks, dilated fundus exam, and visual field testing is recommended to monitor for any glaucomatous changes. Historically, miotic therapy (pilocarpine) has been used to prevent reverse pupillary block and to reduce pigment dispersion, but these agents are often not tolerated well in young patients. Signs of glaucomatous changes, or sustained IOP above 21mmHg indicates conversion to pigmentary glaucoma and requires a higher level of treatment to prevent vision loss.

Treatment of PG: The management of pigmentary glaucoma (PG) is similar to that of POAG - meaning that IOP reduction is our main tool to prevent further vision loss. IOP reduction can be obtained through topical drops aimed at reducing aqueous production such as topical beta-blockers, carbonic anhydrase inhibitors, or alpha agonists.[6] Prostaglandins may also be used since they enhance uveoscleral outflow.

There are also surgical treatment options for PDS/PG.[4,6] Laser peripheral iridotomy (LPI) has been reported to yield strong initial reductions in IOP, however the benefits appear to last for only one to two years. Laser iridotomy may also reverse backward bowing of the iris by flattening the iris, resulting in reduced iridozonular contact and allowing for pressure balance between the anterior and posterior chambers. Laser trabeculoplasty (ALT or SLT) is also an option. Because eyes with heavily pigmented angles are more prone to over-treatment, it is recommended to use the lowest laser setting and treat only two quadrants.[4] The benefits of laser trabeculoplasty decrease quickly over time, and many patients will require additional treatment. If medical and laser treatment options fail to lower IOP to an acceptable level, or if PG is progressing rapidly, filtering surgery such as trabeculectomy must be considered.

Conclusion

PDS and PG represent different stages of the same condition characterized by abnormal iridolenticular contact, and iris pigment liberation and deposition in the anterior segment. This iris pigment collection often causes increased IOP. While the initial disorder affects both sexes, men are more likely to progress to PG and experience vision loss. Because PDS is an asymptomatic chronic condition with a risk of converting into vision threatening secondary glaucoma, it is critical for us to properly inform and educate our patients about their condition and the need for long-term management. Management of PDS consists of careful observation. Frequent examinations including gonioscopy, optic nerve evaluation, and visual field testing are essential to locate early signs of progression. If progression to PG is detected, treatment must be initiated swiftly. Treatment for PG includes topical hypotensive agents (often those with ability to reduce aqueous production), laser procedures such as LPI and SLT, and glaucoma surgery.

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