

Photic maculopathy: five case reports and literature review

Maculopatia fótica: cinco relatos de caso e revisão de literatura

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ABSTRACT

Maculopathy from prolonged exposure to solar light is a rare but well-recognized clinical entity of vision loss and macular damage. Photochemical damage precedes visual decline, and in mild cases, vision usually returns fully or partially. With the advancement of humanity, other forms of macular injuries induced by light radiation have emerged, increasing the group of photic maculopathies. In this report, we describe the cases of five patients where a diagnosis of photic maculopathy was made based on the anamnesis, clinical findings, and complementary exams. We compare the five cases regarding their similarities and differences, as well as review the literature on the subject.

RESUMO

A maculopatia causada pela exposição prolongada à luz solar é uma entidade clínica rara, mas bem reconhecida, de perda de visão e dano macular. O dano fotoquímico precede o declínio visual e em casos leves a visão geralmente retorna total ou parcialmente. Com o avanço da humanidade, surgiram outras formas de lesões maculares induzidas pela radiação luminosa, aumentando o grupo das maculopatias fóticas. Neste relato, descrevemos os casos de cinco pacientes onde o diagnóstico de maculopatia fótica foi feito com base na anamnese, achados clínicos e exames complementares. Comparamos os quatro casos quanto às suas semelhanças e diferenças, bem como revisamos a literatura sobre o assunto.

INTRODUCTION

An optical experiment that children tend to enjoy is to burn things with a magnifying glass with the help of the sunlight, like a sheet of paper. The lens inside our eyeballs can produce a similar effect on the macular photoreceptors, causing an eye injury known as photic maculopathy (PM).

Maculopathy from prolonged exposure to solar light is a rare but well-recognized clinical entity of vision loss and macular damage. It is a disease that has been present in human history. According to Plato's *Phaedo*, Socrates advised individuals to watch an eclipse only through its reflection in the water.⁽¹⁾ Another report date back to the biblical ages, when Saint Paul was temporarily blinded by "a bright light," with the recovery of vision a few days later.⁽²⁾ The solar maculopathy of a student who observed an eclipse was also the central insight that made Gerhard Meyer-Schwickerath use sunlight to apply diathermy to the retina for treating retinal detachments. This revolutionary concept gave rise to photocoagulation in ophthalmology.⁽³⁾

Photic maculopathy is a broad term that encompasses maculopathies caused by a photochemical injury to the macula due to exposure to light. Solar maculopathy is the oldest and best known form, which is also called "solar retinopathy", "solar retinitis", "photic maculopathy", and "eclipse retinopathy".⁽⁴⁾ Macular injury in eclipse viewing is well known, and after major eclipse episode, case series of SM appear in the world literature.^(1,5-12) Cases of solar maculopathy are also seen outside the time of the eclipse, with a higher incidence on extremely sunny days.⁽¹⁾ The habit of staring at the sun found in some populations increases the incidence of the lesion, such as in psychiatric patients,⁽¹³⁻¹⁶⁾ in some religious practices⁽¹⁷⁻²⁰⁾ or with the use of psychoactive drugs.⁽²¹⁻²³⁾ However, the history of sun gazing is not always present.^(24,25)

With the advancement of humanity, other forms of light injury maculopathy have emerged, increasing the group of photic maculopathies that includes Laser Pointer Maculopathy, Welder's Maculopathy and iatrogenic maculopathy from operating microscopes/endoilluminators in eye surgeries. Laser pointers are instruments that can also mimic the action of sun exposure, causing lesions that are often more severe, commonly unilateral, and with a worse prognosis.⁽²⁶⁾ Welding maculopathy is similar to solar maculopathy, differing only in the history of welding and possible presence of welder's keratitis. Maculopathy from operating microscopes/endoilluminators is usually superior or inferior to the fovea and involves an area larger than all other types of photic injuries.⁽²⁷⁾

In this report, we describe five patients treated at Hospital de Olhos do Paraná where a diagnosis of PM was

made based on the anamnesis, clinical findings, and complementary exams that will be shared below.

CASE SERIES

CASE 1

Female patient, 21 years old. She reported worsening visual acuity (VA) in both eyes (AO) a week before the examination, especially in central vision. She reported that she had looked at a solar eclipse without adequate protection just before symptom onset. She denied pain or other associated symptoms. She denied comorbidities or an ophthalmic history other than myopia corrected with glasses.

At the examination, the best corrected visual acuity (BCVA) was 20/50 in the right eye (OD) and 20/70 in the left eye (OS). Slit lamp examination results and intraocular pressure were normal. At fundus examination of AO, there was a well-circumscribed lesion in the foveal region of AO, without other significant changes (Figure 1).

Optical coherence tomography (OCT) analysis showed disruption of the outer layers of the retina and retinal pigment epithelium (Figure 2). Upon return, there was a gradual improvement in VA. After 6 months, the VA was 20/30 and 20/20 in the OD and OS, respectively.

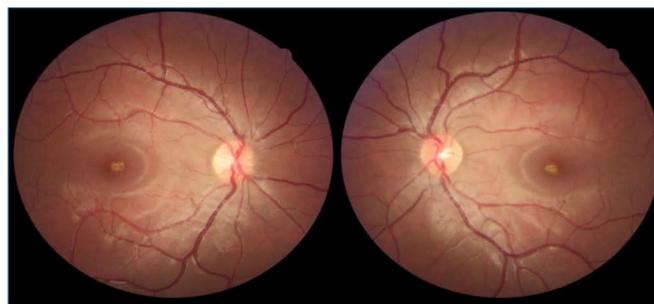


Figure 1. Retinography showing a yellowish well-circumscribed lesion in the foveal region of both eyes.

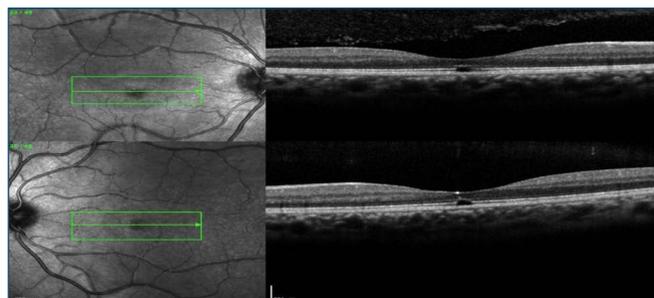


Figure 2. Baseline optical coherence tomography showing disruption of the outer layers of the retina and retinal pigment epithelium in both eyes.

CASE 2

Male patient, 42 years old, diabetic for 2 years on regular metformin use, denies other comorbidities. The

patient reported worsening of central vision for approximately 4 weeks in AO, with no other complaints. He denies events related to the onset of the low acuity episode, even sun gazing.

Ophthalmological examination showed BCVA 20/40 in OD and 20/50 in OS. Slit lamp exam was normal, non-tensive in AO, and funduscopy showed a hypopigmented lesion in the foveal region in AO, without other significant changes (Figure 3).

When analyzing the OCT images, there was an ellipsoid zone disruption underneath the fovea in AO, compatible with an external macular hole, worse in the LE (Figures 4 and 5). According to our follow-up, after 6 months, the patient achieved a BCVA of 20/20 in AO.



Figure 3. Retinography shows a hypopigmented lesion in the foveal region in both eyes.

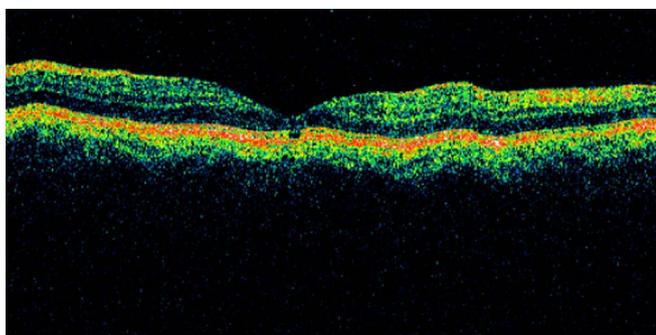


Figure 4. Baseline OCT of the right eye showing an image of ellipsoid zone disruption underneath the fovea in the outer retina and the inner retinal pigment epithelium.

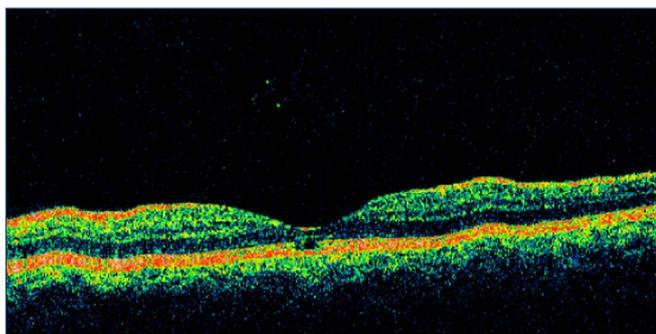


Figure 5. Baseline optical coherence tomography of the left eye also showing an image of an ellipsoid zone disruption underneath the fovea, slightly larger than in the right eye.

CASE 3

Male patient, 55 years old, white, was seen at our hospital reporting low VA in AO, but more intense in the OD for approximately 3 months, without other complaints. He mentions that he works as a bricklayer with sun exposure at various times of the day and without using eyeglasses to protect him from sun exposure. However, no particular moment of sun gazing was cited. He denied traumatic systemic and ocular antecedents. He refers to previous cataract surgery of the OS 3 years ago.

On examination, he had BCVA of 20/50 in OD and BCVA of 20/30 in OS. Biomicroscopy showed 2+ /6+ nuclear cataracts in the OD, and in the OS, pseudophakic with a well-positioned intraocular lens, and no other changes. Funduscopy showed a mild decrease in foveal reflex in AO (Figure 6). OCT images of both eyes showed an image of an ellipsoid zone disruption underneath the fovea (Figure 7 and 8). After 6 months of follow-up, he improved VA to 20/30 and 20/25 in OD and OS, respectively.



Figure 6. Retinography of both eyes showing a foveal reflex attenuation.

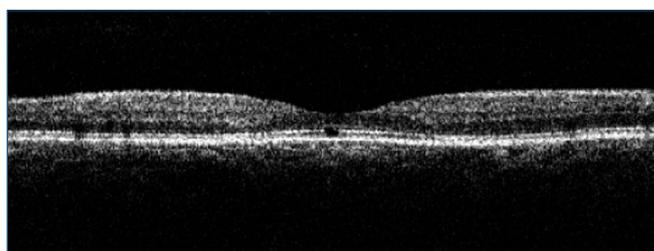


Figure 7. Baseline optical coherence tomography of the right eye showing an outer macular hole.

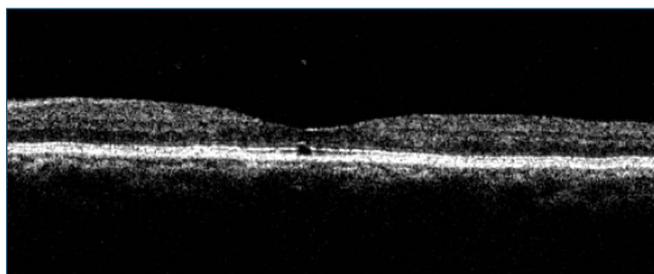


Figure 8. Baseline optical coherence tomography of the left eye showing a similar external macular hole.

CASE 4

Male patient, 8 years old, white, was seen at our hospital reporting low VA in the OD on the day as the appointment. His mother reports exposure to a laser pointer for 2 seconds just before the low vision symptom.

On examination, he had BCVA of 20/20 in AO but mentioned some blurring in the OD. Slit lamp examination results and intraocular pressure were normal. At fundus examination of the OD, there was a tiny well-circumscribed lesion in the foveal region (Figure 9). OCT analysis showed disruption of the outer layers of the retina and retinal pigment epithelium in the OD, and OS without changes (Figure 10 and 11). This case is the most recent and we have not had follow-up data yet.

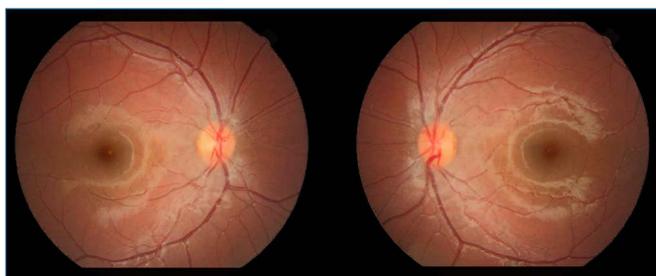


Figure 9. Retinography shows a hypopigmented lesion in the macula of the right eye, slightly nasal to the fovea.

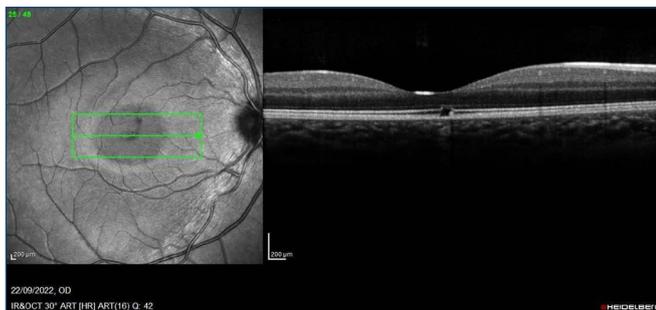


Figure 10. Optical coherence tomography of the right eye showing an external macular hole adjacent to the fovea.

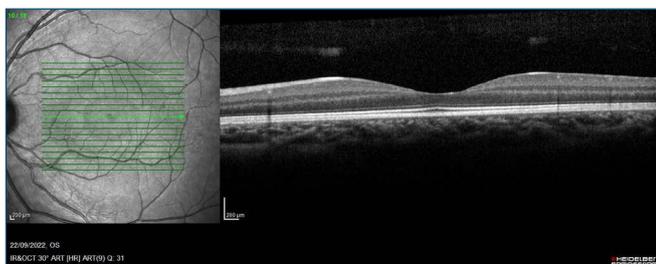


Figure 11. Left eye without significant changes.

CASE 5

Male patient, 13 years old, white, was seen at our hospital reporting low VA in the OD on the day of consultation. The patient was accompanied by his mother, who reported exposure to the green laser two hours before

the appointment. She reported that the exposure was by aiming the laser at the mirror and hitting the eye. At the appointment, the patient reported a black spot in the OD, and no complaints in the OS. On examination, he presented with BCVA of 20/30 in the OD with +6.75 ESF -0.25 CYL and 20/20 in the OS with +6.25 ESF -0.25 CYL but reported that he was unable to see the entire line in the OS, that is, with decreased paracentral acuity.

Upon fundus examination, he presented the classic yellowish stain in the macular area on both sides, being slightly paracentral in the left eye (Figure 12). On OCT, he presented interruption of the ellipsoid zone on both sides, with the right eye having a central macular interruption and the left eye paramacular (Figure 13 and 14).

After 4 months of follow-up of this patient, we have the macular finding of the characteristic hole defect without the yellowish spot in the acute setting and corrected visual acuity of 20/25 in the OD and 20/20 in the OS. The patient reports that he still notices the defect in his right eye, although reporting improvement.



Figure 12. Retinography shows in both eyes a yellowish macular lesion, more centered in the OD and paramacular temporal in the OS

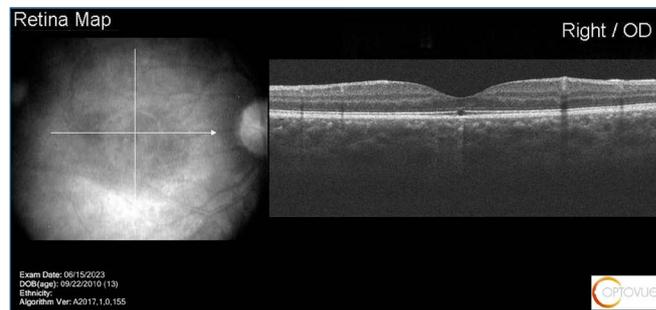


Figure 13. OD with a centered macular disruption of outer layers.

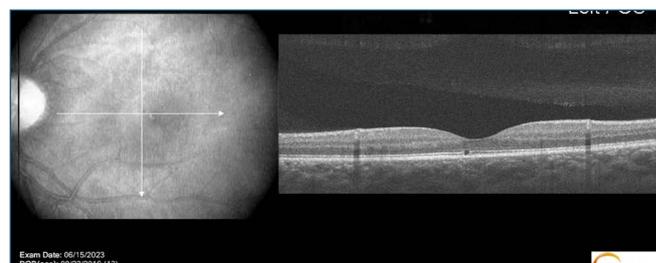


Figure 14. OS with a paramacular macular disruption of outer layers.

DISCUSSION

The lesions are frequently bilateral, asymmetric, and more prominent in the dominant eye.⁽²⁸⁾ On initial funduscopic examination, findings may be mild, such as only a decrease in the foveal reflex, or visualization of a yellowish-white spot on the fovea that suggests acute onset, often surrounded by granular pigmentation.⁽²⁷⁾ In cases 1, 4, and 5, hypopigmentation was seen in the foveal area, although with a more yellowish hypopigmentation compared to case 2, probably meaning a more acute condition. Case 3 had a milder presentation with foveal reflex attenuation, corroborating the findings of a more chronic involvement.

In longstanding PM, there is a small multifaceted outer retinal hole (or holes) with a pigment halo. At first glance, these holes may appear to be small, full-thickness macular holes because of their reddish center. However, on closer inspection, the holes are restricted to the outer retina stereoscopically, and the foveal reflex is often present.⁽⁴⁾ Case 3 depicts this more chronic involvement in which the classic yellow dot on the fovea is no longer seen, but a small macular hole, which on OCT leads to the conclusion that it is an involvement of the outermost layers of the retina.

Visual acuity at diagnosis of our reported patients ranged from 20/20 to 20/70, with a higher prevalence of mild to moderate visual impairment. The finding agrees with the information in the literature. In solar maculopathy, VA commonly ranges from 20/40 to 20/60, although it can range from 20/20 to CF.^(21,29,30) In laser pointer maculopathy, VA is typically worse than what we saw in our patient 4, commonly being 20/200 or worse.⁽²⁶⁾ In patient 5, we see again a tendency for paramacular lesions to come to the office with 20/20, and the central lesion with worse vision, although better than other studies⁽²⁶⁾. As mentioned in the same study⁽²⁶⁾, patients with paramacular involvement usually have a VA of 20/40 or better, as was the case with our patient 4 and the OD of patient 5.

Regarding light exposure history, we had case 1 with proven exposure to the eclipse, case 4 and 5 with proven exposure to the laser pointer, and case 2 and 3 without reporting an acute moment exposure. Patient 3 worked as a bricklayer with daily sun exposure, which may have led to a photic lesion, but we cannot be sure about the factor “acute sun exposure” in this case. In the literature, we classically have sungazing reports in solar maculopathy; however, we also have cases with no report of sun observation.^(24,25) For those cases of external retinal disruption with no history of exposure to sunlight, we could open the

diagnostic reasoning to another etiology, “Foveomacular retinitis”, which has been described a few times in the literature as a form of primary maculopathy distinct from solar maculopathy where there is no sun exposure.^(31,32) The disease can be viral in etiology and is usually self-limiting.⁽³¹⁾ However, Wergeland et al. compared 36 patients in clinical history and examination findings and concluded that, apart from the report of sun exposure, they are identical diseases, if not the same disease.⁽³³⁾ In fact, some studies report both diseases as synonyms, even though some studies report some differences.⁽²⁷⁾

Fluorescein angiography may demonstrate punctate window defects in the foveal area, a finding common to other retinal diseases. However, images with fluorescein or indocyanine angiography are not very useful since the RPE in the foveal area is more pigmented than elsewhere in the fundus, reducing light transmission from the choroid.⁽²⁸⁾

Optical coherence tomography is the exam that brings more clarity in these cases. It presents with an interruption of the outer limiting membrane and the junctions of the inner and outer segments, justafoveal microcysts, and increased foveal hyperreflectivity.⁽²⁸⁾ An outer lamellar cystic change is believed to be produced by either the thermal or the thermally enhanced phototoxic reaction at the photoreceptor level and surface of the retinal pigment epithelium.⁽¹⁾ All five patients in this report showed disruption of the outer layers of the retina in agreement with the literature.

Regarding visual recovery, the first, third, and fifth cases had partial recovery, while the second case had a complete recovery. There seems to be much individual variation in the susceptibility to developing permanent vision loss.⁽²⁷⁾ Correlating with the OCT findings, full-thickness involvement of the photoreceptor layer of the entire fovea indicates an association with permanent vision loss, whereas isolated involvement of the outer or inner segments or a lesion outside the center of the fovea results in a better visual outcome.⁽³⁴⁾ We can see that the OD of patient 1, which had a wider disruption of the outer layers of the retina, had a worse recovery than the OS. This greater involvement of the outer layers of the retina may be related to the lower visual recovery in this case. In case 3, we have a slight asymmetry of visual recovery, worse in the OD; however, it can be explained by the nuclear cataract present only in that eye. Patients 4 and 5 are recent cases that we do not have a big follow-up data, probably able to improve with more months of recovery. We can infer that we will have a better recovery in the right eye of patient 4 and in the left eye of patient 5

who had paramacular disorders. Patient 5 reports that the black spot in his right eye is recovering well, but in the follow-up appointments, we still have the central defect with partial vision of 20/25.

In conclusion, we show here five cases that were diagnosed with PM, with variations concerning types of light exposure or even presence of exposure, symptom duration, retinography findings, and visual recovery.

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