

CASE REPORT

Late optical coherence tomography findings in a patient with solar eclipse retinopathy

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ABSTRACT

Solar retinopathy is a photochemical retinal injury caused by direct or indirect viewing of the sun and characterized by visual distortion and a small yellow or red foveal lesion. Retinal damage can be identified by optical coherence tomography. This paper reports late optical coherence tomography (OCT) findings in a 10-year-old boy with solar retinopathy after watching a solar eclipse. OCT demonstrates abnormalities in the outer foveal retina in late solar eclipse retinopathy with normal Bruch membrane choriocapillaris complex.

Key words: solar retinopathy, optical coherence tomography, eclipse, imaging.

INTRODUCTION

Solar retinopathy has been documented for many years. The cases described at present are related to direct exposure to solar radiations in well-defined circumstances such as solar eclipses, psychiatric disease, religious rituals, use of hallucinogenic drugs, military and astronomy professionals.¹ It results from a cumulative solar radiation exposure beyond the retina's defense mechanisms. A thermally enhanced phototoxic reaction at the outer retina and retinal pigment epithelium (RPE) layers and photochemical retinal injury appears to be the pathogenic mechanisms.^{2,3} The most frequent visual symptoms are decreased vision, central scotoma, dyschromatopsia, metamorphopsia, micropsia, and frontal or temporal headache, within hours of exposure.

Funduscopy reveals, in the first few days after exposure, a yellow-white spot in the fovea, which subsequently is replaced after several days by a reddish dot, often surrounded by a pigment halo. After approximately 2 weeks, a small, reddish, well-circumscribed, lamellar hole or depression may evolve. Fluorescein angiography demonstrates leakage in early stages and window defects in late stages.³

The diagnostic approach used to be on history and fundus examination. Recently the advent of optical coherence tomography (OCT) has opened new diagnostic possibilities.

CASE REPORT

A 10-year-old emmetropic boy referred on 2011, January, with complaint of decreased vision. Taking history revealed looking directly, continuously and binocularly at the sun for 2 minutes during solar eclipse

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which took place one week ago on January 4th. He was not aware of using goggles to protect eyes. He said not to use systemic or topical drugs, and he had no ocular or medical history. Best corrected visual acuity (BCVA) was 20/70 in both eyes. The anterior segment and intraocular pressure were normal in each eye. A central scotoma and metamorphopsia were noted bilaterally on the Amsler grid test. Dilated fundus examination found an alteration in the foveal reflex. There was a reddish dot, surrounded by a pigment halo in the fovea. In 5 weeks follow up the patient reported an improvement in his vision. BCVAs were 20/25 and 20/30 in right and left eyes respectively. The fluorescent angiography was normal. Fundus examination revealed merely diminished foveal light reflex. OCT abnormalities were limited to the outer aspect of the foveal retina. Imaging disclosed a discontinuity within the inner-outer segment junction of photoreceptor reflective band and retinal pigmented epithelium with preserved foveal contour. No abnormality was seen in other layers of retina and vitreo-retinal interface.(Fig. 1) The patient was examined again one year later, repeating the diagnostic tests performed in the first checkup. Visual acuity remained unchanged. The Amsler grid test and fluorescent angiography were normal. Fundus examination and OCT findings were still the same.(Fig. 2)

DISCUSSION

Solar retinopathy is also known as eclipse burn, eclipse blindness, or eclipse retinopathy, because the majority of cases have been watching a solar eclipse. This is not the only cause of solar retinopathy, and there are in fact numerous reports of maculopathy following the direct sun viewing. These cases usually have a history of sun gazing because of presumed ritualistic or religious habits, sun worshiping, mental illness with elements of blindness, or use of hallucin-

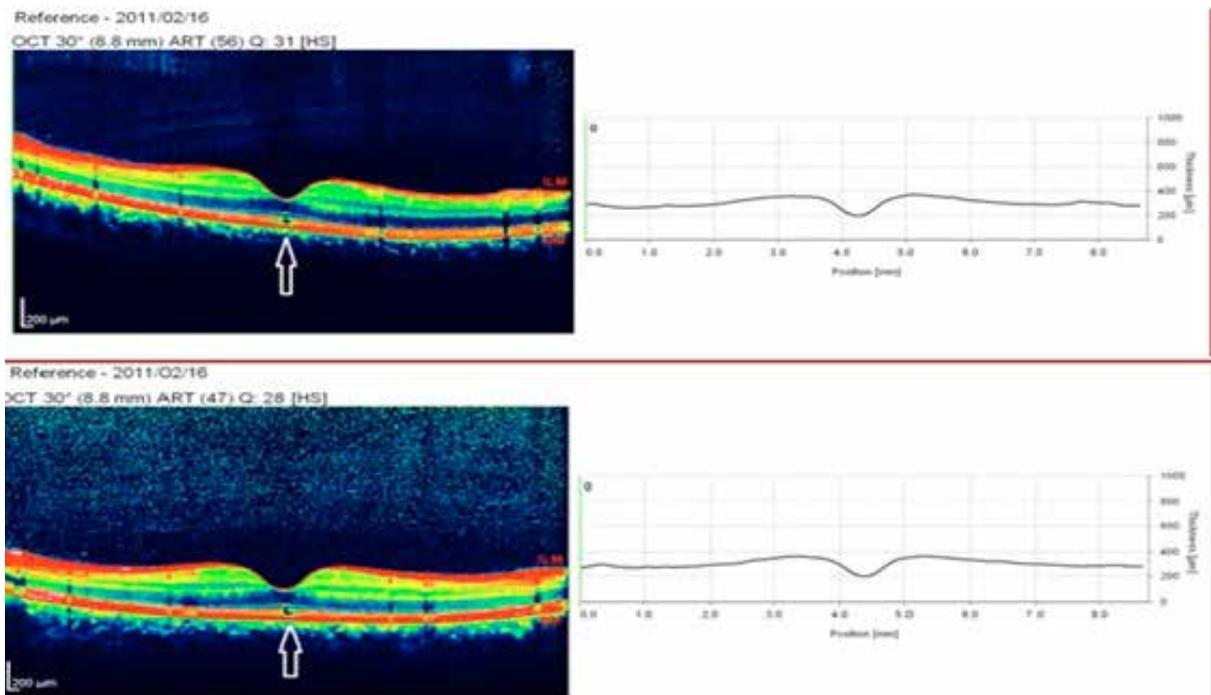


Figure 1, OCT image shows discontinuity within the inner-outer segment junction of photoreceptor reflective band and retinal pigmented epithelium with preserved foveal contour (arrow)

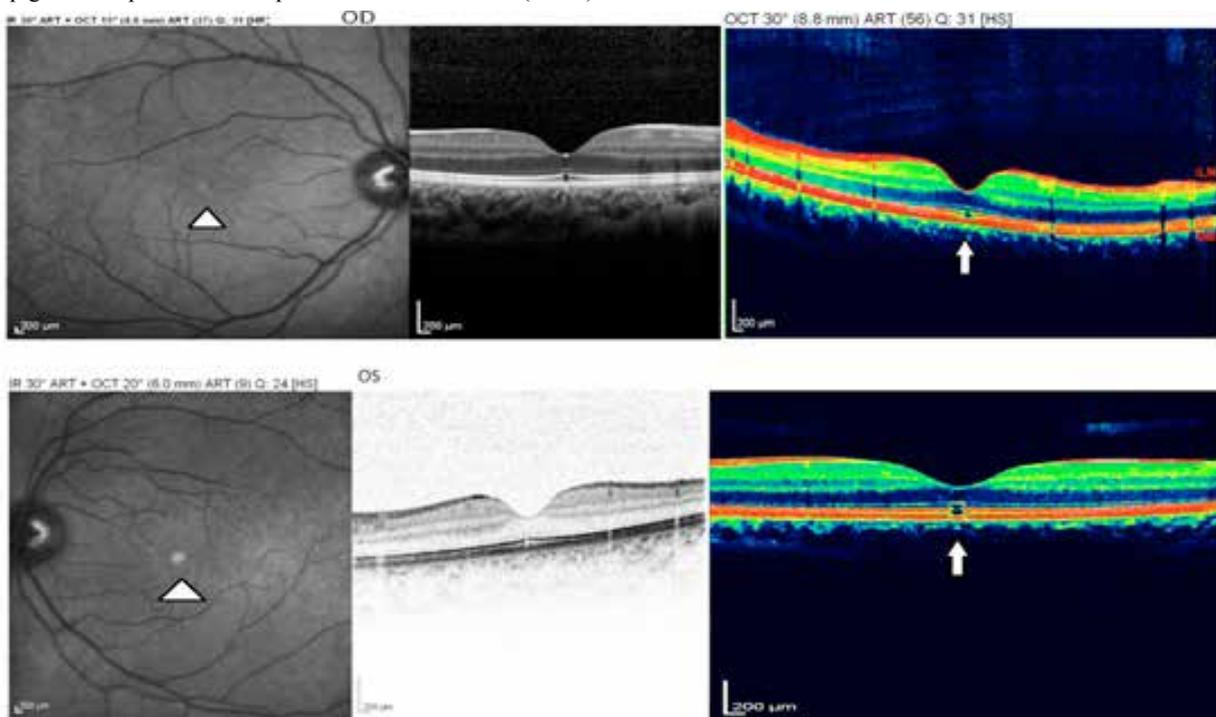


Figure 2, Infrared photography shows a small white spot in the foveal area (arrowhead); the corresponding OCT image findings are still the same 1 year later.

ogenic drugs such as LSD, Military personnel assigned to survey the sky for enemy aircraft, seamen, and astronomers are also at risk of developing this form of retinopathy.⁴

Light can cause photomechanical, photochemical or photo thermal retinal damage.⁵

Unassisted observations of the sun at its zenith with a 3mm pupil diameter produce only a 4°C temperature rise, below the 10°C temperature elevation needed for threshold retinal photocoagulation, thus solar retinopathy is usually caused by retinal photo toxicity not

photocoagulation.^{6,7} Solar radiation produce pointed damage in the apical melanosomes of the RPE followed by alterations in the outermost segment of foveal photoreceptors.^{1,8}

The diagnosis of solar retinopathy relies on history of sun gazing, funduscopy, and fluorescein angiography findings.^{1,2} OCT and multifocal electroretinogram (mfERG) can provide useful morphological and functional information, respectively.^{9,10}

Bechmann et al. were the first who described OCT finding soon after sunlight exposure.¹¹ These authors

reported 2 cases in which the OCT showed a hyper reflective area in the fovea, with all retinal layers being affected without changes in the retinal thickness. These lesions were reversed after 9 days. Yeh et al. reported 1 case of lamellar hole 6 months after sunlight exposure detected by OCT.¹²

Jorge et al. evaluated late solar retinopathy by using third generation OCT in 4 eyes of three patients and demonstrated abnormalities in the outer foveal retina such as fragmentation or interruption of the inner high reflective layer corresponding to photoreceptor inner-outer segment junction in all patients. Involvement of the entire photoreceptor reflective layer at the fovea was observed in the patient with decreased visual acuity.¹³

Kaushik et al. described the OCT findings for three eyes of two patients with clinical findings compatible with a diagnosis of solar retinopathy, one month and 3 years after exposure.¹ The principal alteration observed in OCT was an excavated area in the hyper reflective layers of the retinal pigment epithelium-choroid complex, with a hyper reflective area in the outer retinal layers representing damaged photoreceptors.

Calvo-Gonzalez et al. describe a case of a patient suffering from acute visual loss soon after watching a solar eclipse. Exploration with OCT-III revealed a clear defect in the external segment of foveal photoreceptors, without any other significant findings. Two months later OCT demonstrated a defect in the external segment of foveal photoreceptors although of a lesser magnitude than the one of the first assessment.¹⁴

Garg et al. describe the OCT findings in eight eyes of four patients with late solar retinopathy. All patients had a history of sun gazing months to years prior to presentation. OCT showed a preserved foveal contour and a normal vitreo-retinal interface with no evidence of posterior vitreous detachment. The neurosensory retina was highly attenuated in the foveal region with significant thinning overlying a small, hypo reflective space in the outer retinal and retinal pigment epithelium (RPE) layers. The remainder of the RPE-choriocapillaris layer was normal.⁸

Codenotti et al. observed 4 patients with solar retinopathy after watching a solar eclipse. OCT showed some abnormalities like reduction in the intensity of the reflectiveness of the RPE, reduction in the reflectiveness or nonreflective spaces between the inner retinal layers, an increased reflectiveness of the inner retinal layers in fovea. All these alterations shown by OCT disappeared after 1 month and were not seen after 1 year of follow-up.⁴

Chen et al. reported a 34-year-old man complained of blurred vision of 15 years' duration in both eyes.

In the past, as part of a religious ritual, he stared at the sun with both eyes for several minutes at a time on multiple occasions. OCT described almost entirely absent of outer nuclear layer in the foveal region, and vertical bands of hypo reflectivity through the pho-

toceptor inner segment/outer segment junction and outer segments demonstrated focal areas of photoreceptor cell death. The external limiting membrane, retinal pigment epithelium (RPE), and Bruch membrane/choriocapillaris complex appeared normal.¹⁵

In the present study, we observed a patient who came to our attention one week after the solar eclipse of January 4th, 2011. He had decreased vision and fundus examination reveals reddish dot, surrounded by a pigment halo in the fovea.

In the recent study, according to the OCT, however inner retina appeared normal, outer retina was destructed. Precisely there was a hypo reflective interruption area in the inner segment/outer segment junction, outer segment of photoreceptor layer and RPE layer, preserved foveal contour. It is noteworthy that Bruch membrane and choriocapillaries are normal. OCT findings and physical examination remained unchanged after 1 year follow up. Both OCT related to the chronic phase of solar retinopathy.

In contrast to Jorge et al. in this study decreased visual acuity was not related to full thickness photoreceptor damage and inner retina was intact.

Our study advocated the hypothesis that solar retinopathy is limited to outer retina because of its high susceptibility to solar radiation damage. Retinal damage extent was different in literatures. Some spared RPE whereas others involved RPE too, as occurred in our case. This inequality is contributed to the severity of damage.

CONCLUSION

According to this study and other related studies we conclude that OCT demonstrates abnormalities in the outer foveal retina in late solar eclipse retinopathy. It would be a beneficial modality to facilitate solar retinopathy diagnosis especially in the absence of a clear history of sun-looking.

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