The purpose of this article is to compare spectral-domain (SD) and time-domain (TD) optical coherence tomography (OCT) findings in patients with solar retinopathy. Complete ocular examinations and OCT were performed in two patients presenting with acute solar retinopathy soon after observation of an eclipse. Both patients were evaluated with SD-OCT and TD-OCT at the same time. SD-OCT demonstrated characteristic defects at the level of the inner and outer segment junction of the photoreceptors in all the affected eyes and decreased reflectiveness of the retinal pigment epithelium layer. TD-OCT images showed unremarkable findings in two eyes with deteriorated visual acuity. SD-OCT improves diagnosis and assessment of the degree and nature of foveal damage in patients with solar retinopathy and may be an important tool for use in identifying foveal damage not detected by TD-OCT. SD-OCT may be preferable to TD-OCT for confirmation or assessment of the degree of foveal damage in patients with solar retinopathy.

Key Words: Optical coherence tomography, Retinal disease, Solar energy
unremarkable. No alteration was seen in either eye using FA. TD-OCT (Stratus OCT; Carl Zeiss Meditec Inc., Dublin, CA, USA) and SD-OCT (Spectral OCT/SLO; OTI Ophthalmic Technologies Inc., Miami, FL, USA) were used for macular scanning. TD-OCT examination revealed a minimal abnormality of the inner thin hyperreflective layer (HRL), corresponding to the junction between the inner and outer photoreceptor segments at the fovea. However, SD-OCT captured more clearly a disrupted inner segment and outer segment (IS/OS) line, as well as decreased intensity of the reflectiveness of the RPE in the foveolar area of the right eye (Fig. 1). The left eye appeared normal on TD-OCT and SD-OCT. After 4 months, the patient reported an improvement in his vision; however, the central scotoma remained. Best corrected visual acuity of the right eye was 20/25, and the yellowish-white spot was still in the foveolar area of the right eye; however, it was smaller than before.

Case 2

A 10-year-old boy came to our attention one day after a solar eclipse, reporting blurred vision in the left eye. He said he had watched the sun continuously, for about 30 seconds, during the eclipse, without any protection. He had no ocular trauma or medical history. His best corrected visual acuity was 20/25 in the left eye, and 20/20 in the right eye. No alterations were noted bilaterally on the Amsler grid test. The anterior segment in each eye was unremarkable. Fundus examination revealed a small yellowish-white spot in the foveal area of the left eye. Fundus examinations of the right eye were unremarkable. The left eye was his dominant eye. No alteration was observed in either eye using FA. TD-OCT examination revealed unremarkable findings; however, SD-OCT captured a small but significant disrupted IS/OS line in the foveolar area of the right eye, and decreased reflectiveness of RPE (Fig. 2). The right eye appeared to have normal findings on TD-OCT and SD-OCT. After five months, the patient reported an improvement in his vision. The best corrected visual acuity of the left eye was 20/20.

Discussion

In solar retinopathy, photochemical damage mediated by highly reactive free radicals is believed to be the predominant mechanism of retinal injury; Gass [5] postulated that blue wavelengths of light are chiefly responsible for the production of this photochemical injury, which manifests as damage to the apical melanosomes of the RPE. This is followed by disruption of photoreceptors. Pathologic changes are largely confined to the outer segments of the photoreceptor in the fovea, with fine structural anomalies in the RPE layer that may lead to depigmentation [6].

Current understanding of the pathophysiology of solar retinopathy is in line with OCT images. TD-OCT reports of
acute solar retinopathy indicate a predominance of outer HRL damage with minimal or no inner HRL damage [7]. The superficial inner thin HRL of TD-OCT represents the junction between the inner and outer photoreceptor segments, and the deeper thick outer HRL represents RPE. In the acute stage of solar retinopathy, input of irradiation is absorbed preferentially by melanosomes in the RPE. Defects of the outer HRL may correspond to necrotic PRE and loss of melanin granules [6]. With prolonged exposure, the damage may extend to involve the outer segments of the photoreceptor, perhaps through thermal mechanisms, which is consistent with the inner HRL defect found on the TD-OCT.

To the best of our knowledge, in most previous reports, TD-OCT alone was used for evaluation of solar retinopathy. Despite the remarkable clinical utility of TD-OCT, it also has limitations. TD-OCT is limited by axial resolution (10 μm), image acquisition speed, and a small number of scans. Limitations of TD-OCT may result in sampling errors, and may lead to missed areas of pathology due to incomplete scanning of the macular [4]. In fact, in our cases, TD-OCT missed or did not show the precise pathology of the macula. When damage to the retina in solar retinopathy was limited to the outer segments of the photoreceptors, and changes were minute, TD-OCT may have missed the pathology.

In Case 2, SD-OCT showed a significantly small disrupted IS/OS line and abnormal hyperreflectivity outer segments of photoreceptors in the foveolar area. This finding suggests that outer segments of photoreceptors and the associated RPE layer were the site primary affected with acute solar retinopathy.

In conclusion, in two eyes with solar retinopathy, we demonstrated that SD-OCT may be preferable to TD-OCT for demonstration and diagnosis of solar retinopathy. When a patient’s history of sungazing is difficult to elicit, or in cases with unremarkable findings from other ocular examinations, despite sungazing history, SD-OCT imaging will assist in the diagnosis of this unique retinal condition, particularly in the early stage, or in patients with minimal change.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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