Imaging Serpiginous Choroidopathy With Spectral Domain Optical Coherence Tomography

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ABSTRACT
The use of spectral domain optical coherence tomography (SD-OCT) in the study of chronic serpiginous choroiditis was evaluated. Two patients with chronic serpiginous choroiditis were imaged using two prototype SD-OCT systems (6-µm axial resolution). Raster scans covering 6 × 6 × 2-mm regions of the retina were obtained, enabling the study of different retinal cross-sectional images. Thickness maps were obtained after segmentation of retinal layers, which could be compared with those on follow-up. SD-OCT allowed the visualization of the cross-sectional retinal architecture at different horizontal positions. Superimposition of SD-OCT generated reconstructed fundus images with fundus photographs provided accurate images registration. Segmentation of retinal layers provided thickness maps and higher-density improved visualization of photoreceptor layer, cysts, and atrophy, which was useful in following change in disease activity over time. The researchers concluded that SD-OCT is a useful tool to study disease morphology and follow-up of chronic serpiginous choroiditis. [Ophthalmic Surg Lasers Imaging 2008;39:S95-S98.]

INTRODUCTION
Serpiginous choroiditis is a rare, usually bilateral, chronic, progressive, recurrent inflammation of the retinal pigment epithelium (RPE), choriocapillaris, and choroid of unknown etiology. It has a wide spectrum of disease presentation, including macular helicoid chorioretinal degeneration, macular serpiginous choroiditis, ampiginous choroiditis, and relentless placoid chorioretinitis. Histologic findings of the lesions are reported to be atrophy of the RPE-choriocapillaris and photoreceptor cells, moderate diffuse lymphocytic infiltrates throughout the choroid (more so at the margin of the lesions), and extension of fibroglial scars into the subretinal space.1 Choroidal neovascularization, the most common and visually significant ocular complication, occurs in 13% to 35% of the patients.2

Fundus photography, fluorescein angiography, and indocyanine green angiography have traditionally been used to diagnose and follow these lesions. However, optical coherence tomography (OCT) may provide more information regarding the location and extent of these lesions.3 Spectral domain OCT (SD-OCT) allows for much faster acquisition time than time domain OCT (TD-OCT) and covers larger regions of the retina, which in turn enables the quantification of retinal structure and allows repeated, noninvasive
measurements to track disease progression. SD-OCT has the potential to improve image quality, retinal coverage, and registration.

This article reports two patients with chronic serpiginous choroiditis who were imaged using two 6-µm axial resolution prototype SD-OCT systems—Cirrus OCT (Carl Zeiss Meditec, Inc., Dublin, CA) and a Bascom Palmer Eye Institute prototype system (Miami Macula Mapper)—and the analysis was performed.

CASE REPORTS

Case 1

A 62-year-old man, who had been observed for 24 years with chronic serpiginous choroiditis in both eyes and treated with systemic prednisone, azathioprine, and valacyclovir, was examined at Bascom Palmer Eye Institute. Best-corrected visual acuity was 20/40 in the left eye. Fundus photography showed peripapillary atrophic chorioretinal scarring, with the fovea appearing normal and the peripheral retina showing marked pigmented scarring (Fig. 1). Indocyanine green angiography precisely demarcated the lesions (Fig. 1, top right).

SD-OCT provided detailed visualization of retinal architecture, including the presence of retinal atrophy in the peripapillary region, with disruption of the photoreceptor layer and thinning of the RPE and mild cystic changes in the retina very close to the fovea (Fig. 1, scan 3). A raster scan covering a $6 \times 6 \times 2$-mm volume of the retina was obtained, enabling study of multiple horizontal retinal cross-sections. Superimposition of the SD-OCT generated reconstructed fundus image with fundus photographs (Fig. 1, left lower) provided accurate image registration. Thickness maps, shown in Figure 2, were obtained from segmentation of the internal limiting membrane and RPE layers. There was an increase in retinal edema on 3 months’ follow-up (Fig. 2, bottom) compared with baseline. However, visual acuity improved to 20/30 in the left eye.

Figure 1. Case 1, initial visit. Fundus photograph of the left eye (top left) shows the presence of serpiginous lesions and retinal atrophy. More pigmented atrophy is present in the periphery. ICG angiography is useful in demarcating the healthy retina from the more atrophic areas (top right). The SD-OCT reconstructed fundus image (obtained from the raster scan pattern) is shown in the bottom left and can be superimposed on the fundus photograph using blood vessels as landmarks. Registration of B-scans is possible with the fundus photograph, as shown in the figure. B-scans 1-3 on the bottom right correspond on lines 1-3 on the reconstructed SD-OCT fundus (bottom left). There is evidence of retinal atrophy in the peripapillary region just nasal to the fovea, with the foveal architecture being relatively normal. A visual acuity of 20/40 can be explained by the continuous IS/OS in the foveal region.
Case 2

An 80-year-old woman with chronic bilateral serpiginous choroidopathy and a history of associated choroidal neovascularization in the right eye had a visual acuity of 20/400 in that eye. Fundus photography (Fig. 3, top) showed the presence of subretinal fibrosis and atrophy in the peripapillary region.

The SD-OCT high-density scan (Fig. 3, bottom) through the fovea showed retinal atrophy, subretinal fibrosis, and some intraretinal fluid. Additionally, there was marked attenuation of the inner segment/outer segment junction (IS/OS).

DISCUSSION

The long-term natural history of serpiginous choroiditis is one of multiple recurrences and progressive fibrosis that may eventually involve the fovea and result in poor visual outcome. Active lesions may resolve over a few months or persist for almost a year. The accelerated resolution of active lesions in serpiginous choroiditis when treated with steroids and various anti-inflammatory agents also indicates that inflammation may play an important role in the pathogenesis of serpiginous choroiditis. Combination therapy consisting of cyclosporine A, azathioprine, and prednisone has been tried, but no randomized clinical trial on the treatment of serpiginous choroiditis has been performed.

The high speed of SD-OCT allowed for acquisition of high-density images achieving 4,096 A-scans in 0.16 second, resulting in improved visualization of subtle changes such as intraretinal cysts, the photoreceptor layer, and retinal scarring, as well as change in retinal fluid after steroid therapy in both cases. Raster scans provided visualization of the retina at different horizontal levels in high definition and accurately registered the areas of atrophy and edema with the fundus.
photographs (Fig. 1). This was useful in point-to-point comparison on follow-up (Fig. 2). In Figure 1, accurate image registration has been shown by superimposing the OCT-generated fundus image (using three or more blood vessels as landmarks and tilting the OCT fundus image so that accurate overlap occurs), which is not possible using traditional TD-OCT systems such as the Stratus OCT. Another feature of SD-OCT is that it generates thickness maps (shown in Figs. 1 and 2) after three-dimensional segmentation of the retina. This is a novel method of monitoring change in retinal edema (Fig. 2). In case 1, the patient’s good visual acuity (20/40) could be explained by the relatively normal fovea with a more continuous IS/OS. In addition, the increased intraretinal cystic changes on follow-up suggest an inflammatory response. In case 2, 20/400 vision could be explained by retinal atrophy and the attenuated IS/OS.

Some of these SD-OCT features may potentially improve the monitoring follow-up of chronic serpiginous choroiditis.

REFERENCES