Identifying Live Nematodes in Diffuse Unilateral Subacute Neuroretinitis by Using the Scanning Laser Ophthalmoscope

Lucio R. Moraes, MD; Arnaldo P. Cialdini, MD; Marcos P. Avila, MD, PhD; Ann E. Elsner, PhD

**Objective:** To describe use of the scanning laser ophthalmoscope (SLO) to identify live nematodes in patients with diffuse unilateral subacute neuroretinitis.

**Methods:** Infrared, red, and blue illumination (780, 633, and 488 nm, respectively) in an SLO were used to image and evaluate functional retinal status in patients with late-stage diffuse unilateral subacute neuroretinitis. An examination to identify live nematodes was performed in the affected eyes.

**Results:** Using blue illumination, the ocular fundus appeared dark and provided a high-contrast background for the white image of the worm. The red laser was used to perform red-on-red perimetry. We also used perimetry stimulus to stimulate the worm’s movement and pin-point its location. We precisely defined the relation between the fixation point and the worm to plan accurate laser treatment. The infrared laser is safe and comfortable for prolonged examination. Using the SLO, several physicians simultaneously visualized the ocular fundus. Video output from the SLO provided temporal information, excellent for enhancing detection of worms, which was displayed dynamically on video.

**Conclusions:** Although examination with a fundus contact lens by skilled ophthalmologists is the method of choice, the SLO provides a new examination modality with distinct advantages for identifying live worms in young patients with diffuse unilateral subacute neuroretinitis.


**DIFFUSE UNILATERAL subacute neuroretinitis (DUSN) is a clinical syndrome characterized in the early stage by visual loss, vitritis, papillitis, retinal vasculitis, and recurrent crops of evanescent gray-white outer retinal lesions and later by progressive visual loss, optic atrophy, retinal vessel narrowing, and diffuse retinal pigment epithelium (RPE) degeneration occurring in one eye of otherwise healthy patients.**

The first patient, to our knowledge, with documented bilateral nematodes was described recently. During the early course of the disease, visual acuity may be normal or minimally affected. In many patients, particularly in young children, the disease remains undetected until the visual acuity decrease is found during a school vision examination.

Diffuse unilateral subacute neuroretinitis is caused by at least 2 unidentified nematodes of different sizes that vary in length from 400 to 2000 µm. Cialdini et al recently reported the first South American case of DUSN caused by the larger nematode. The nematode can be found at any stage of the disease and should be sought in patients with optic atrophy, narrowing of the retinal vessels, and advanced degenerative RPE changes.

A careful search using a fundus contact lens is required to locate smaller worms, which are barely visible by indirect ophthalmoscopy using a 20-diopter lens. Larger worms are relatively easy to detect using indirect ophthalmoscopy and are most likely found near active, deep, white retinal exudative lesions, which are probably caused by a toxic inflammatory reaction to material left in the wake of the nematode moving in the subretinal space. The magnification and wide field of view provided by a fundus contact lens and the fundus camera are the preferred methods for visualizing these worms but may require prolonged and repeated examinations that are troublesome mainly because of patients’ young age and poor fixation. Early diagnosis of the disease is important because destruction of the worm with laser photocoagulation prevents further loss of visual function and occasionally can be followed by improvement in vision.
We used the scanning laser ophthalmoscope (SLO) to identify live nematodes in patients with DUSN, and we describe several distinct advantages of the SLO system over conventional photography.

REPORT OF CASES

CASE 1

An 11-year-old girl with the presumed diagnosis of diffuse bilateral subacute neuroretinitis was referred to Bom Jesus Hospital, Ceres, Brazil, for a second opinion. She had previously undergone laser treatment in both eyes without improvement in vision. Her visual acuity levels were 20/200 OD and counting fingers OS. Biomicroscopy revealed a normal anterior segment in both eyes. Signs of mild vitritis associated with a path of RPE degeneration were seen in both eyes; degeneration was worse in the left eye, which also had an extremely pale optic nerve. Multiple crops of evanescent gray-white outer retinal lesions were seen temporal to the macula in the right eye, which had marked RPE involvement. Diffuse bilateral subacute neuroretinitis was suspected. Fundus biomicroscopy revealed a normal anterior segment in both eyes. 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tory investigations were negative. A stool sample was free of ova and parasites. There was no history of cutaneous larval migrans. One month after laser treatment, the patient’s visual acuity improved to 20/60 OD; visual acuity in the left eye remained unchanged.

CASE 2

An 8-year-old boy was first seen in January 1999 with a history of vision loss in the right eye resulting from a diagnosis of “retinal lesions” made by his ophthalmologist 1 year previously. His visual acuity levels were 20/400 OD and 20/20 OS. There was no afferent pupillary defect in either eye. Bilateral intraocular pressure was 13 mm Hg. Biomicroscopy showed a normal anterior segment in both eyes and vitreous cells in the right eye. The right fundus examination showed a pale optic nerve, narrowing of the retinal vessels, and focal plus diffuse RPE degeneration. The left fundus was normal. Diffuse unilateral subacute neuroretinitis was suspected in the right eye, but careful contact lens examination did not identify a motile subretinal worm because of poor patient cooperation. However, argon laser treatment was applied to the superior temporal retina in 2 small areas where we suspected that a small worm might be present. After 4 weeks of laser treatment, visual acuity was unchanged (20/400 OD), and no worm was seen. In December 2000, the patient returned. Visual acuity remained 20/400 OD. An SLO examination identified a motile 550- to 650-µm nematode inferonasally in the right eye. The worm’s movements were easily seen on the SLO video monitor (Figure 3) and were recorded on videotape. The subretinal worm was destroyed using laser photocoagulation. The patient was lost to follow-up.

CASE 3

A 15-year-old girl had an 18-month history of progressive visual loss in the left eye. An ophthalmologist who examined her initially diagnosed optic nerve atrophy. There was no history of ocular inflammation or pain. The patient complained of occasional headaches. Visual acuity levels were 20/20 OD and hand motions OS. There was a relative afferent pupillary defect in the left eye. Intraocular pressure measurements and anterior segment biomicroscopic findings were normal in both eyes. A few cells were seen in the anterior vitreous in the left eye. The left fundus had severe optic nerve atrophy, narrowing of the retinal vessels, and marked RPE degeneration in the posterior pole. The electroretinogram was severely reduced (B wave < A wave). Diffuse unilateral subacute neuroretinitis was suspected in the left eye, and a motile 400- to 500-µm subretinal nematode was found inferotemporally during SLO examination (Figure 4). The nematode was destroyed using continuous argon green laser treatments (150-200 mW, 150-µm spot size). The patient was lost to follow-up.

COMMENT

The SLO uses a novel optical principle to obtain high-quality images of the human retina. The instrument enables several physicians to view the ocular fundus simultaneously. This is potentially beneficial for finding areas of special interest during examination and for facilitating the training of young physicians in the techniques needed to recognize the worm in patients with late-stage DUSN. The instant feedback that the video provides allows the examiner to optimize laser power and video gain settings and to examine areas of special interest using high magnification.

**Figure 3.** Argon blue laser (488-nm) scanning laser ophthalmoscopic composite fundus photographs (direct mode) of the right eye show the various shapes of the subretinal motile nematode inferonasally (arrows) and demonstrate its coiling and uncoiling movements.

**Figure 4.** Helium-neon laser (633-nm) scanning laser ophthalmoscopic fundus photograph (direct mode) of the left eye shows the subretinal motile nematode (arrow) inferotemporally (40° field).
The contrast of the features in the image can be improved by using the confocal imaging system. We used direct-mode imaging with a circular aperture; the smaller the aperture, the more the image is determined from directly reflected or backscattered light from the plane of focus. Unique to scanning laser tomography, crops of evanescent gray-white outer retinal lesions were seen at different depths, as described with exudative features in RPE detachment.\textsuperscript{12,13}

The SLO video output provides a retinal image that can be reviewed dynamically and repeatedly on video, and thus, a vital frame is unlikely to be missed. This extra temporal information allows clinicians to perceive events not visible in standard static photographs. In clinical examination, the areas of retinal edema obscure the worm and its movements, which are important for identification. Patients with DUSN are frequently children or young adults with an affected retina and photophobia, so it is difficult for them to cooperate during the long examination necessary to locate a small worm. The SLO provides for safe and comfortable examination and thus improves patient cooperation. In clinical examination, a slitlamp is used, which provides only a partial view of the retina. An SLO can display the entire posterior pole live on a video monitor.

The results of an SLO examination are available instantly, allowing immediate laser treatment. This is important in patients with DUSN because continuous movement of the worm across the eye causes further damage to the neuroretina. Immediately after laser treatment, digitized SLO images allow production of simple overlays to confirm that laser treatments completely destroyed the worm. Early diagnosis of the location of the worm is fundamental in the treatment of DUSN and occasionally provides a better visual prognosis, as seen in case 1.

In summary, careful clinical examination by skilled ophthalmologists still plays a key role in the diagnosis of DUSN. The SLO technique, a new method for identifying live nematodes in DUSN, has several distinct advantages over conventional photography and might allow better management of this disease in young patients.

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Corresponding author and reprints: Lúcio R. Moraes, MD, Centro Brasileiro de Cirurgia de Olhos, Av. T2 no 401 Setor Bueno, Goiânia—Goiás 74210-010, Brazil (e-mail: moraesl@terra.com.br).

REFERENCES