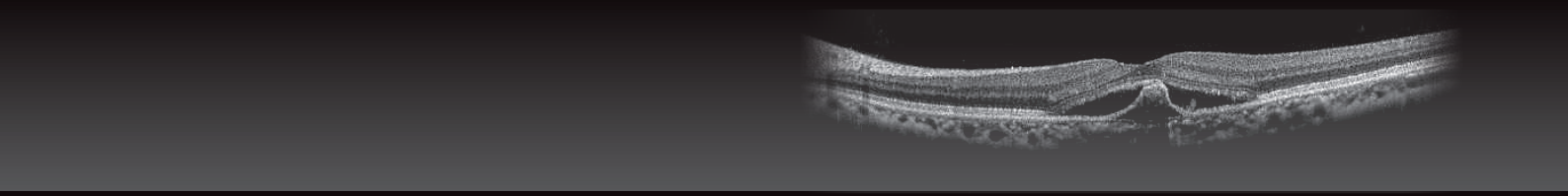
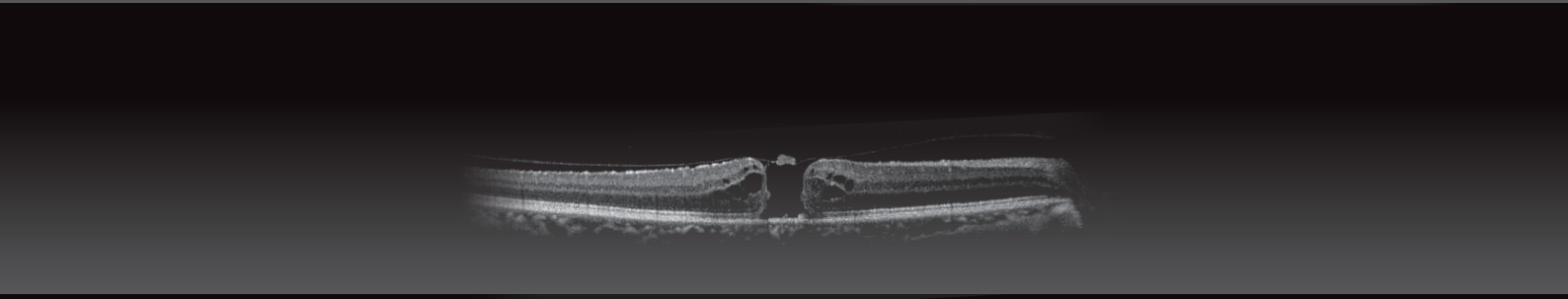
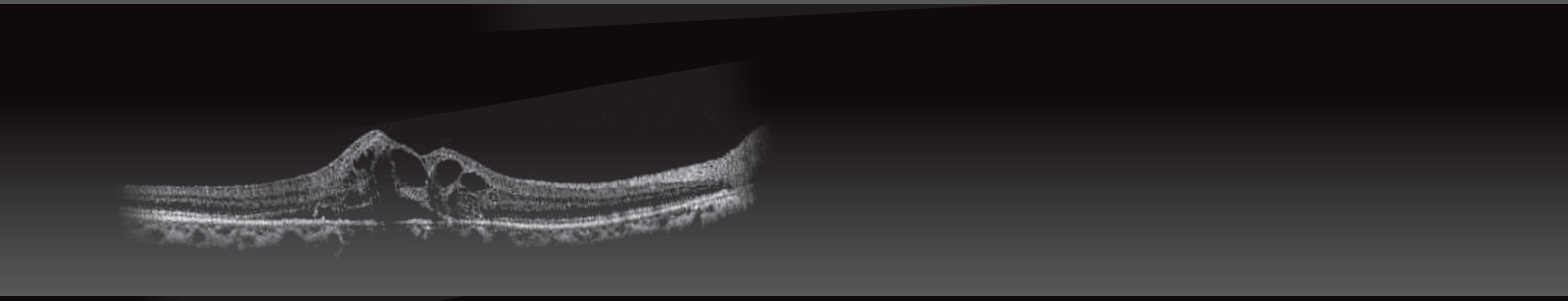
NIDEK *OCT Clinical Case Reports* RS-3000







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The case examples are provided by
Department of Ophthalmology,
Fukushima Medical University School of Medicine

RS-3000 OCT Scan Pattern Settings

Scan Pattern	Content	Setting Items
Macula Line	Line scan	■ Capturing position (within SLO capturing range) ■ Line length (3mm-9mm) ■ Angle (changes counterclockwise in increments of 15°) ■ Maximum image averaging (50)
Macula Cross	Horizontal and vertical line scans	■ Capturing position (within SLO capturing range) ■ Line length (3mm-9mm) ■ Maximum image averaging (50)
Macula Map	Macula area map scan (3D)	■ Capturing position (within SLO capturing range) ■ Range (3mm-9mm both horizontally and vertically) ■ Scan type: Scan direction (X→Y or Y→X direction), Scanning frequency (1024x64, 512x128, or 256x256 A-Scan) ■ Image averaging (None)
Macula Multi	5 horizontal and vertical line scans	■ Scan type: Cross (5 scan lines in the X & Y directions), Horizontal (5 scan lines) or Vertical (5 scan lines) ■ Capturing position (within SLO capturing range) ■ Line length (3mm-9mm) ■ Maximum image averaging (10)
Macula Radial	Radial line scans centered on the macula	■ Scan line number (6 scan lines or 12 scan lines) ■ Capturing position (within SLO capturing range) ■ Line length (3mm-9mm) ■ Maximum image averaging (10)
Disc Circle	Circle scan surrounding optic disc	■ Capturing position (within SLO capturing range) ■ Diameter of circle scan (3mm-9mm) ■ Maximum image averaging (50)
Disc Map	Disc area map scan (3D)	■ Capturing position (within SLO capturing range) ■ Range (3mm-9mm both horizontally and vertically) ■ Scan type: Scan direction (X→Y or Y→X direction), Scanning frequency (1024x64, 512x128, or 256x256 A-Scan) ■ Image averaging (None)
Disc Radial	Radial line scans centered on the disc	■ Scan line number (6 scan lines or 12 scan lines) ■ Capturing position (within SLO capturing range) ■ Line length (3mm-9mm) ■ Maximum image averaging (10)

RS-3000 Clinical Experience

Department of Ophthalmology,
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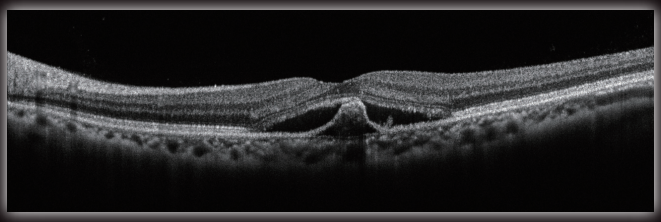
Supervisor: Professor Tomohiro Iida

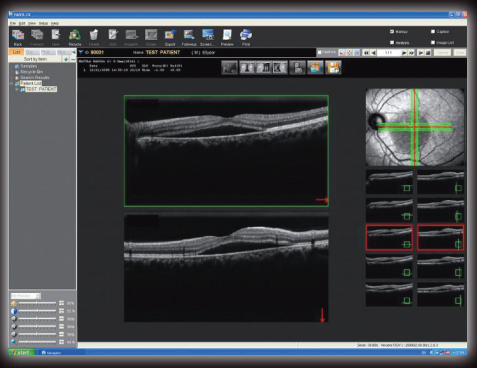
Optical Coherence Tomography (OCT) has advanced from time domain to spectral domain systems which are rapidly becoming prevalent in clinical practice. NIDEK's OCT device, the RS-3000, launched in July 2009 is a Japanese-made spectral domain OCT. My experience with the RS-3000 is summarized below.

① Due to the high-speed scanning capability, 53,000A-Scan/sec, images are captured rapidly. Images are captured in approximately 1 second with the Macula Multi scan mode and 1.6 seconds for the 9mm×9mm Macular Map scan mode.
② Simple, user friendly operation allows any staff member to operate the unit. The easy operation and short measuring time reduce the burden on patients, without compromising the image quality regardless of the operators' skills.
③ The use of the maximum 50 OCT image averaging function provides images with minimal speckle noise.
④ High-resolution SLO & OCT images make it easy to identify the location of a lesion within the fundus.
⑤ Software based on different age brackets provides analyses to assist glaucoma and retinal disease diagnosis.



I recommend the NIDEK OCT because of the easy operation, high quality images and excellent analysis software. Newer versions of software modules and an enhanced user interface are expected in the near future.

Capture Screen



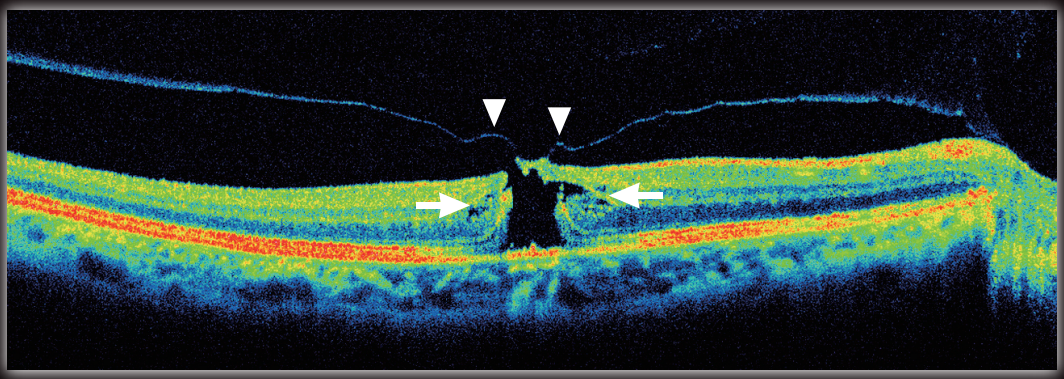
Preview Screen

<Case 1> Idiopathic Macular Hole

A 65 year-old, female, visual acuity (0.09)
Chief Complaint: Central scotoma in the right eye

- Color fundus image (Figure 1) shows a yellow ring (arrow) in the central fovea and a cleft within the yellow ring.
- OCT image (Figure 2) shows a full-thickness stage 2 macular hole. A cleft is caused by traction of the posterior vitreous cortex (arrow-head). Arrows indicate the presence of cysts in the vicinity of the macular hole.

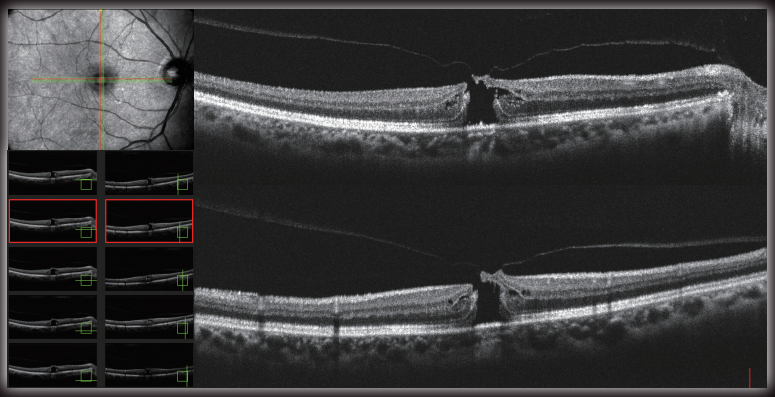
【Figure 1】Color Fundus Image



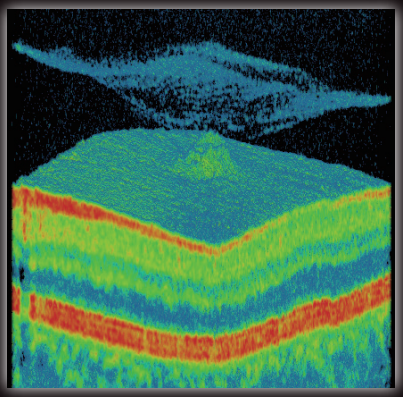
【Figure 2】OCT Image

OCT Capturing Tips

With the Macula Multi scan mode (5 horizontal and vertical line scans), 10 scan images can be captured rapidly. Selecting images with cysts and clefts aids in the accurate assessment of the stage of the disease (Figure 3). Additionally, 3D images are easily generated with the Macula Map which are useful in explaining pathology to other ophthalmic personnel and patients (Figure 4).



【Figure 3】Macula Multi Image



【Figure 4】Macula Map Image

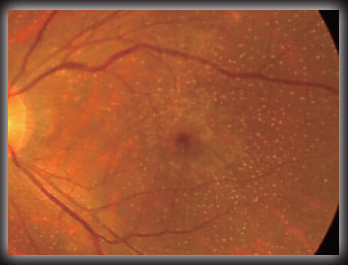
OCT Reading Tips

A thin fluid cuff and cysts at the edge of the macular hole are present. OCT is very useful in explaining pathology to patients and for postoperative follow-up. For patient education, we recommend showing a normal image as a reference in order to facilitate patient understanding of their pathology. Selection of either a pseudo-colored image or gray scale image is available. Fine details are better observed with the gray scale image.

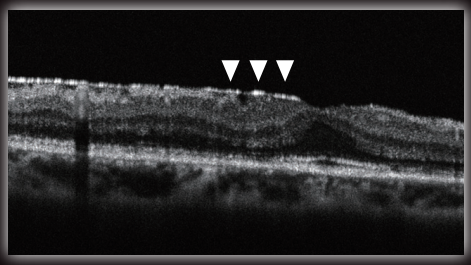
<Case 2> Idiopathic Epiretinal Membrane

A 65 year-old, female, visual acuity (0.6)
Chief Complaint: Vision distortion and decreased visual acuity in the left eye

- Color fundus image (Figure 5) shows an epiretinal membrane (ERM).
- OCT image (Figure 6) shows a reduced foveal depression due to traction on the retina by the ERM (arrow-head).



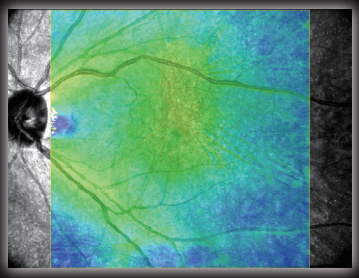
【Figure 5】Color Fundus Image



【Figure 6】OCT Image

OCT Capturing Tips

In this case of an absence of the foveal depression, the external layer of the foveal retina is elevated, forming a triangle-shaped area with low reflection. For patients with poor fixation the selection of the Macula Multi scan mode with the scan passing through the central fovea (among the 10 captured images) is recommended. The color-coded map (Figure 7) or 3D image (Figure 8) with the Macula Map scan mode allows the delineation of the boundaries of the ERM.



【Figure 7】Macula Map Image

【Figure 8】3D Macula Map Image

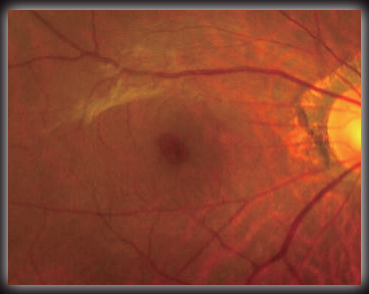
OCT Reading Tips

The highly reflective area on the retinal surface represents the ERM. Retinal thickening is also observed. The OCT is an excellent patient education tool to explain the diagnosis and the effect of treatment.

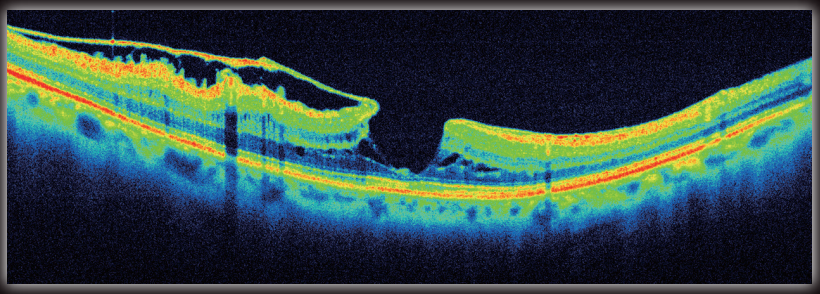
<Case 3> Pseudo Macular Hole

A 74 year-old, male, visual acuity (0.7)
Chief Complaint: Metamorphopsia and decreased visual acuity in the right eye

- Color fundus image (Figure 9) shows characteristics similar to a macular hole below an epiretinal membrane (ERM).
- OCT image (Figure 10) shows a deep cylinder shaped foveal depression with an ERM above. The thickness of the neuroepithelial layer at the bottom of fovea is normal.



【Figure 9】Color Fundus Image



【Figure 10】OCT Image

OCT Capturing Tips

Select the Macula Multi scan mode for patients with poor fixation due to a macular hole, etc.

OCT Reading Tips

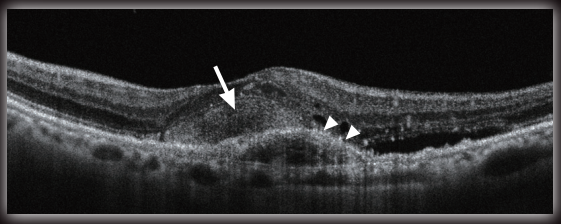
In cases of a pseudo-macular hole, an ERM is present near the macular hole-like finding and a cylindrical shaped foveal depression is present. The neuroepithelial layer of the retina is visible and a thin fluid cuff at the edge of the macular hole is not present.

<Case 4> Age-related Macular Degeneration

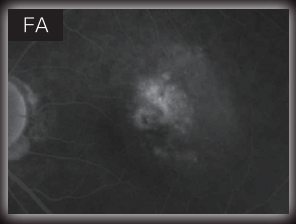
An 83 year-old, male, visual acuity (0.3)
Chief Complaint: Decreased visual acuity in the left eye

- Color fundus image (Figure 11) shows hard exudates around a gray-white lesion in the macula.
- OCT image (Figure 12) shows a gray-white lesion detected as a highly reflective elevation (arrow) above an elevated retinal pigment epithelium (arrow-head).
- Fluorescein angiography (FA) image (Figure 13) shows an occult choroidal neovascularization with intense leakage during the late phase.

【Figure 11】Color Fundus Image



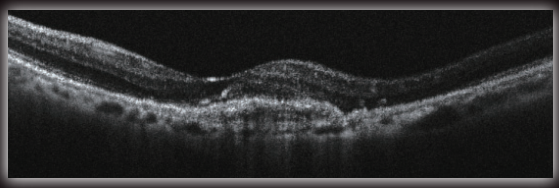
【Figure 12】OCT Image



【Figure 13】FA Image

OCT Capturing Tips

The diagonal line scan passing through the fovea allows observation of pathological changes.
Additionally, image capture with the follow-up function is very useful in monitoring the results of treatment (Figure 14).



【Figure 14】OCT Image (1 month after anti-VEGF treatment)

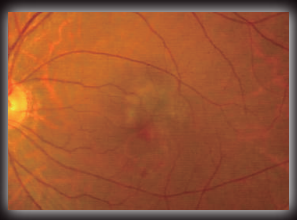
OCT Reading Tips

In age-related macular degeneration, evaluation for the presence of retinal edema, subretinal fluid and elevation of pigment epithelium is warranted. The detachment of pigment epithelium appears as a dome-like elevation.

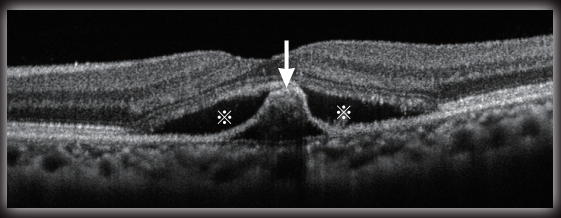
<Case 5> Polypoidal Choroidal Vasculopathy

A 64 year-old, male, visual acuity (1.0)
Chief Complaint: Vision distortion in the left eye

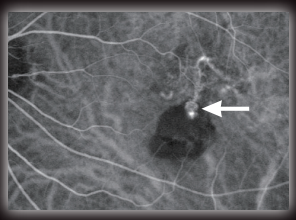
- Color fundus image (Figure 15) shows an orange-red lesion in the macula.
- OCT image (Figure 16) shows significant elevation of the retinal pigment epithelium, RPE (arrow) and serous retinal detachment (※).
- Indocyanine green angiography (IA) image (Figure 17) shows a polyp in the orange-red lesion (arrow).



【Figure 15】Color Fundus Image



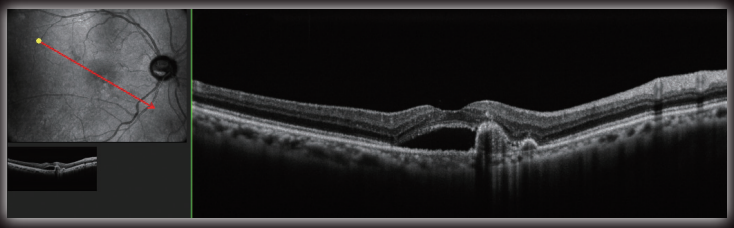
【Figure 16】OCT Image



【Figure 17】IA image

OCT Capturing Tips

The diagonal line scan enables simultaneous monitoring of the impact of the lesion and the central fovea. (Figure 18: OCT Image of a different case)



【Figure 18】OCT Image
Simultaneous capturing of the lesion and central fovea

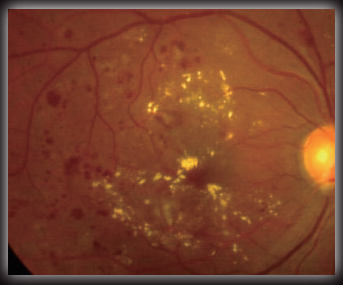
OCT Reading Tips

In polypoidal choroidal vasculopathy, the steep elevation of the RPE indicates a polypoid lesion and the irregular moderate elevation of the RPE represents an abnormal vascular network. These features were helpful in making the diagnosis.

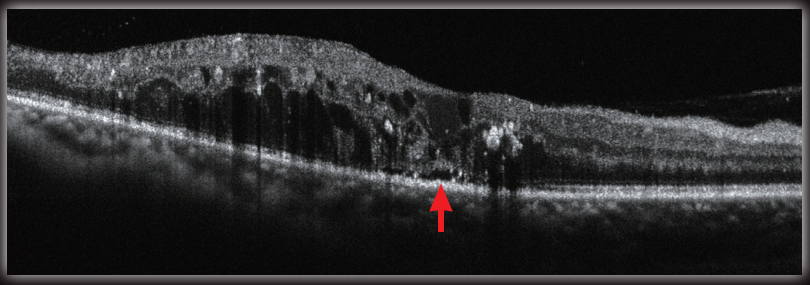
<Case 6>Diabetic Macular Edema

A 49 year-olad, male, visual acuity (0.2)
Chief Complaint: Decreased visual acuity

- Color fundus image (Figure 19) reveals hard exudates and a hemorrhage in the macula.
- OCT image (Figure 20) proves absence of the foveal depression, and the image shows thickening of the retina, cystoid macular edema (CME) and localized serous retinal detachment (red arrow).

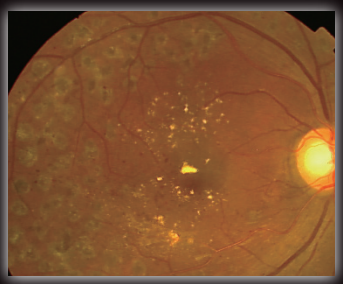


【Figure 19】Color Fundus Image

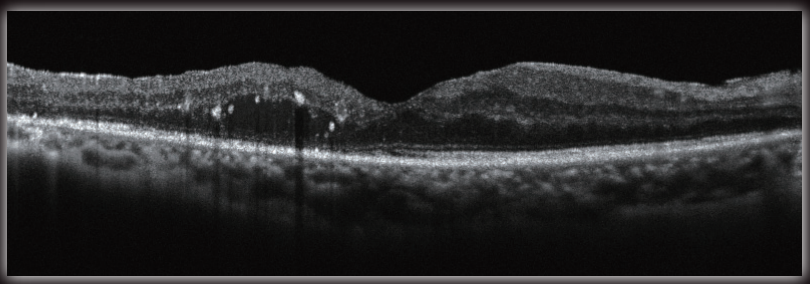


【Figure 20】OCT Image

- Color fundus image captured 6 months after vitreous surgery (Figure 21) shows a reduction of hard exudates and the retinal hemorrhage.
- OCT taken 6 months after vitreous surgery (Figure 22) shows resolution of the serous retinal detachment and CME and a reduction in retinal thickening, the visual acuity improved to 0.4.



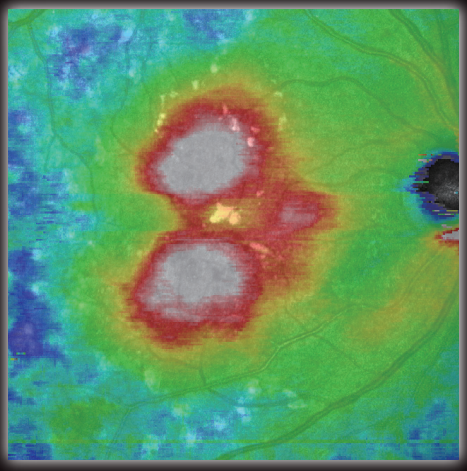
【Figure 21】Color Fundus Image



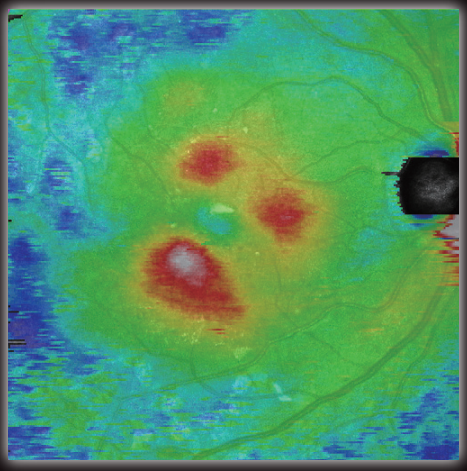
【Figure 22】OCT Image

OCT Capturing Tips

The 9mmx9mm wide area scan with the Macula Map allows an expanded view of edema (Figure 23 and 24).



【Figure 23】Macula Map Image (Preoperative)



【Figure 24】Macula Map Image (6 months after vitreous surgery)

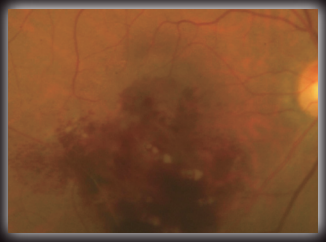
OCT Reading Tips

In diabetic macular edema, follow-up and assessment of treatment outcomes are easily performed with the Macula Map. Additionally, it is useful in explaining pathology to patients.

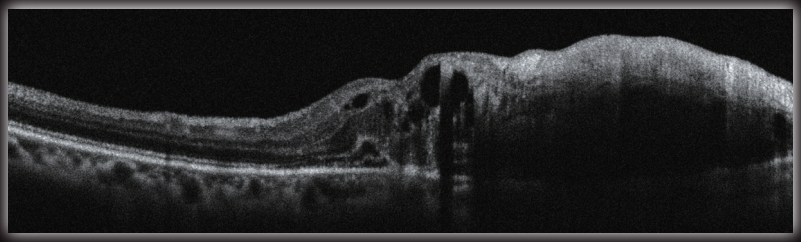
<Case 7> Branch Retinal Vein Occlusion (BRVO)

A 71 year-old, female, visual acuity (0.07)
Chief Complaint: Decreased visual acuity in the left eye

- Color fundus image (Figure 25) shows a retinal hemorrhage inferotemporally and cystoid macular edema (CME).
- OCT image (Figure 26) shows a serous retinal detachment beneath the fovea and CME. Additionally, significant thickening of the retina is observed although the outer layer of the retina affected by BRVO is obscured due to retinal bleeding.



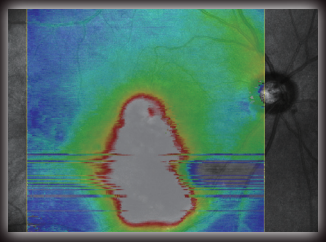
【Figure 25】Color Fundus Image



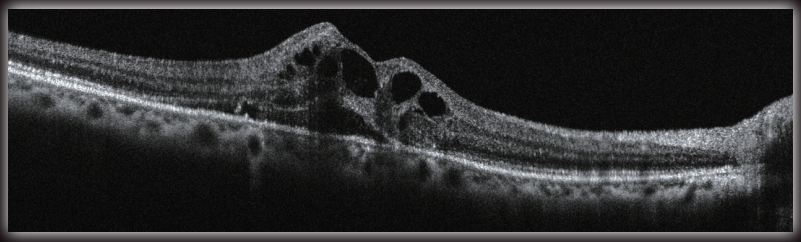
【Figure 26】OCT Image

OCT Capturing Tips

In BRVO, the affected site and healthy retina can be compared with a vertical line scan.
The wide area image with the Macula Map scan mode allows observation of the affected site and the degree of edema (Figure 27).



【Figure 27】OCT Macula Map Image (9mmx9mm)



【Figure 28】OCT Image

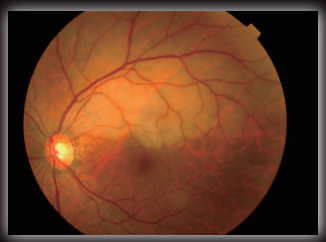
OCT Reading Tips

Observation of the extent of edema and changes in size are easily visualized and useful for follow-up.

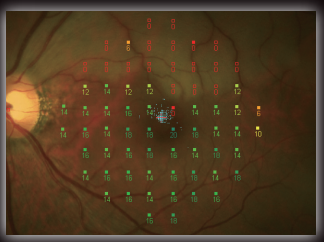
<Case 8> Branch Retinal Artery Occlusion (BRAO)

A 69 year-old, male, visual acuity (1.5)
Chief Complaint: Visual field loss in the left eye

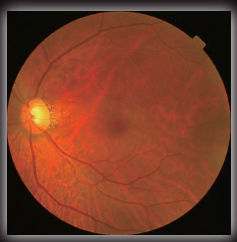
- Color fundus image (Figure 29) shows the typical appearance of the fovea and presents pale and cloudy retina surrounding the supero-temporal arcade.
- Microperimetry (MP-1) image (Figure 30) demonstrates reduced sensitivity supero-temporally (denoted by red squares).



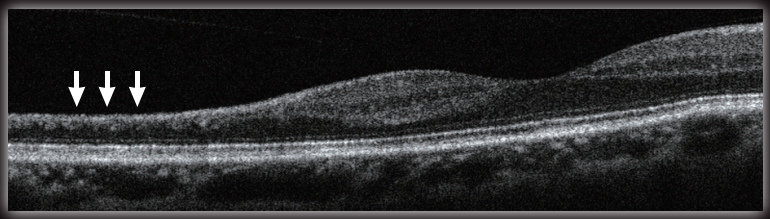
【Figure 29】Color Fundus Image



【Figure 30】Image with MP-1

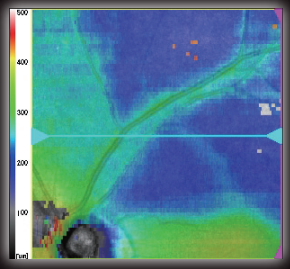


【Figure 31】4 years after the onset of BRAO



【Figure 32】OCT Image captured 4 years after the onset of BRAO. The left hand is the upside.

OCT image taken 4 years after the onset of BRAO shows the thinning of the inner retinal layer (arrows) where the occlusion occurred (Figure 32, 33).



【Figure 33】OCT Macula Map Image (ILM-RPE)

OCT Capturing Tips

Similar to the BRVO case presented previously, comparison of the occluded portion and healthy retina is possible with the vertical line scan. Additionally, with the OCT Macula Map scan mode, the extent of thinning (specifically the thinning of the inner retinal layer) can be clearly observed (Figure 33).

OCT Reading Tips

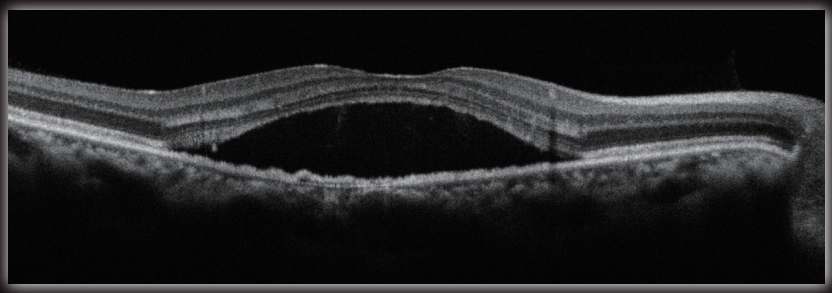
In BRAO, thinning of the inner retinal layer occurs in the affected region, yet the outer retinal layer is normal. This observation is helpful in diagnosing a case with decreased or impaired vision of unknown cause that occurred some time after the onset of the disease.

<Case 9> Central Serous Chorioretinopathy

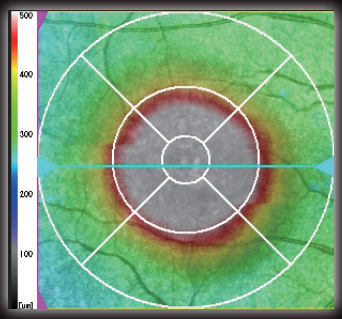
A 45 year-old, male, visual acuity (0.7)
Chief Complaint: Decreased visual acuity and vision distortion in the left eye

- Color fundus image (Figure 34) shows a serous retinal detachment approximately 1.5-disc diameters in size that includes the macula.
- With OCT (Figure 35) evaluation, the serous retinal detachment appears as an area of low reflectivity representing fluid retention beneath the retina.

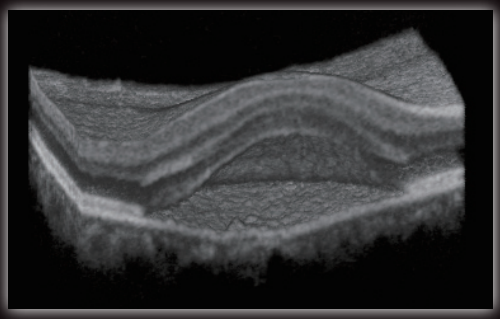
【Figure 34】Color Fundus Image



【Figure 35】OCT Image



【Figure 36】OCT Macula Map Image



【Figure 37】OCT Macula Map Image (3D Display)

The Macula Map scan mode is recommended for evaluating the entire extent of the serous retinal detachment (Figure 36). In addition, the OCT macula map (3D image display) reveals small elevations scattered on the retinal pigment epithelium (Figure 37).

OCT Capturing Tips

In the Macula Map scan mode, the fovea and small elevations of the retinal pigment epithelium can be easily identified (Figure 36 and 37).

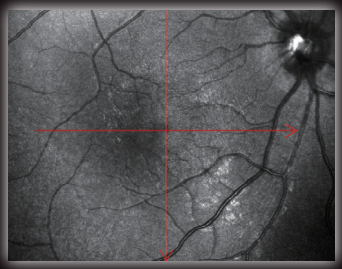
OCT Reading Tips

The OCT is useful for follow-up because it detects even a small retinal detachment that cannot be identified with ophthalmoscopy.

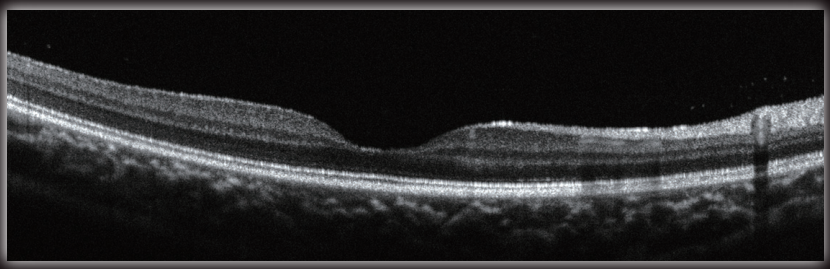
<Case 10> Pediatric OCT Scan

A 4 year-old, girl, visual acuity of the right eye (0.7)
Chief Complaint: Decrease in visual acuity

▌SLO image (Figure 38) shows extortion due to overaction of the inferior oblique muscle.
▌OCT image (Figure 39) appears normal and no organic abnormality in the macula is observed.



【Figure 38】 SLO Image



【Figure 39】 OCT Image

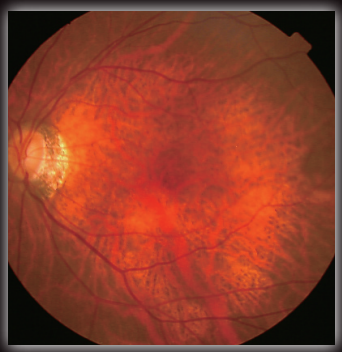
OCT Capturing Tips

Fundus examination on children is often difficult due to the short attention span and lack of cooperation. Hence fundus observation may not be accurate. Therefore, it is important that an exam and measurement are conducted as quickly as possible to reduce the burden on the child and ensure an accurate examination. The recommendation is to avoid complicated scans and use the simple and easy Macula Cross scan mode. The high-speed scan and clear SLO images are very effective in pediatric cases.

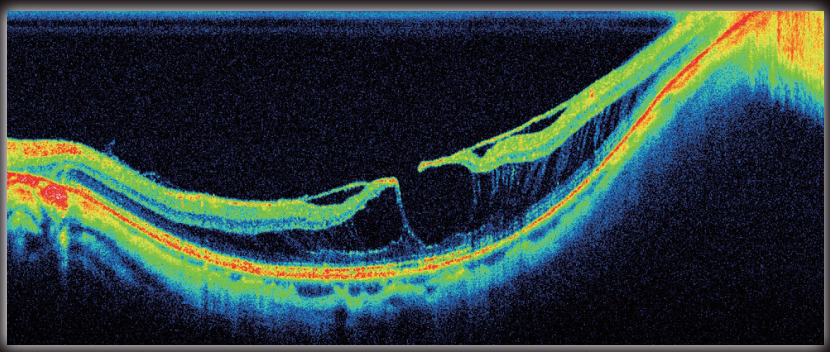
<Case 11> High Myopia

A 77 year-old, female, corrected visual acuity (0.7)
Chief Complaint: Decreased visual acuity and vision distortion in the left eye

▌Color fundus image (Figure 40) does not show any abnormality other than myopic change.
▌OCT image (Figure 41) shows a splitting of the outer retinal layer and an epiretinal membrane.



【Figure 40】 Color Fundus Image



【Figure 41】 OCT Image

OCT Capturing Tips

RS-3000 provides clear OCT images even in patients with high myopia. To observe a wide area view, the use of the 9mm line scan is recommended.

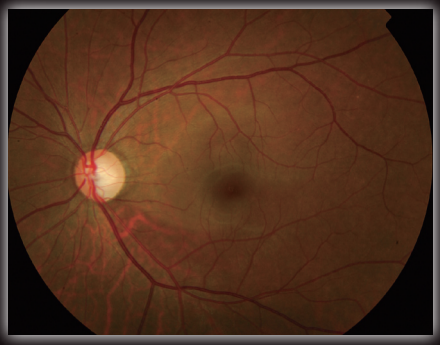
OCT Reading Tips

In high myopia accompanied with visual distortion, retinoschisis or choroidal neovascularization should be suspected. OCT evaluation can aid in the diagnosis of retinoschisis.

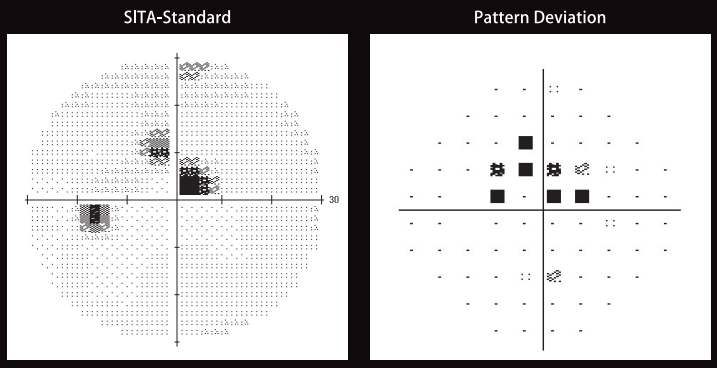
<Case 12> Normal Tension Glaucoma

A 37 year-old, male, left eye IOP (15mmHg)
Chief Complaint: This patient was referred to an ophthalmologist due to optic disc cupping discovered during an annual medical checkup.

▌Color fundus image (Figure42) shows a nerve fiber layer defect (NFLD) inferotemporally.
▌Humphrey visual field image (Figure43) reveals visual field defect corresponding to the NFLD.



【Figure 42】Color Fundus Image



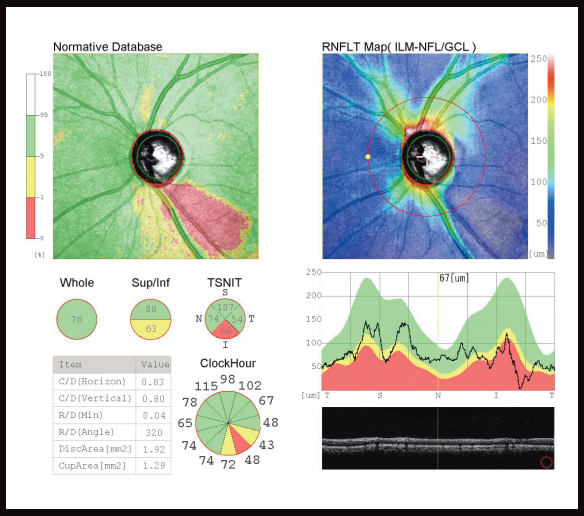
【Figure 43】Humphrey Visual Field *Normal limits

OCT Capturing Tips

RS-3000 allows examination of a wider area, incorporating both the optic disk and the macula.

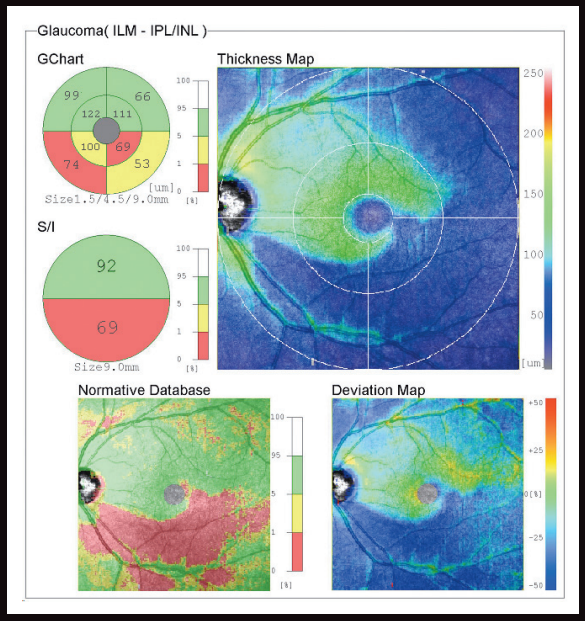
OCT Reading Tips

The incorporation of the images and data obtained with the RS-3000 in combination with the remainder of the ophthalmic examination and perimetry, enhances the accuracy of a diagnosis of glaucoma.



【Figure 44】Disc Map

The Disc Map allows for measurement of the peripapillary nerve fiber layer thickness and comparison of patient data to a normative database.



【Figure 45】Macula Map (Glaucoma Analysis)

For glaucomatous eyes, the Macula Map scan mode is useful. It captures a 9mmx9mm wide area image, and the glaucoma analysis provides measurement of the thickness of the inner retinal layers (ILM-IPL/INL). With the GChart and S/I, abnormal thickness of inner layer of the retina can be identified, and nerve fiber layer defects are clearly indicated compared to a normative database.

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