NIDEK

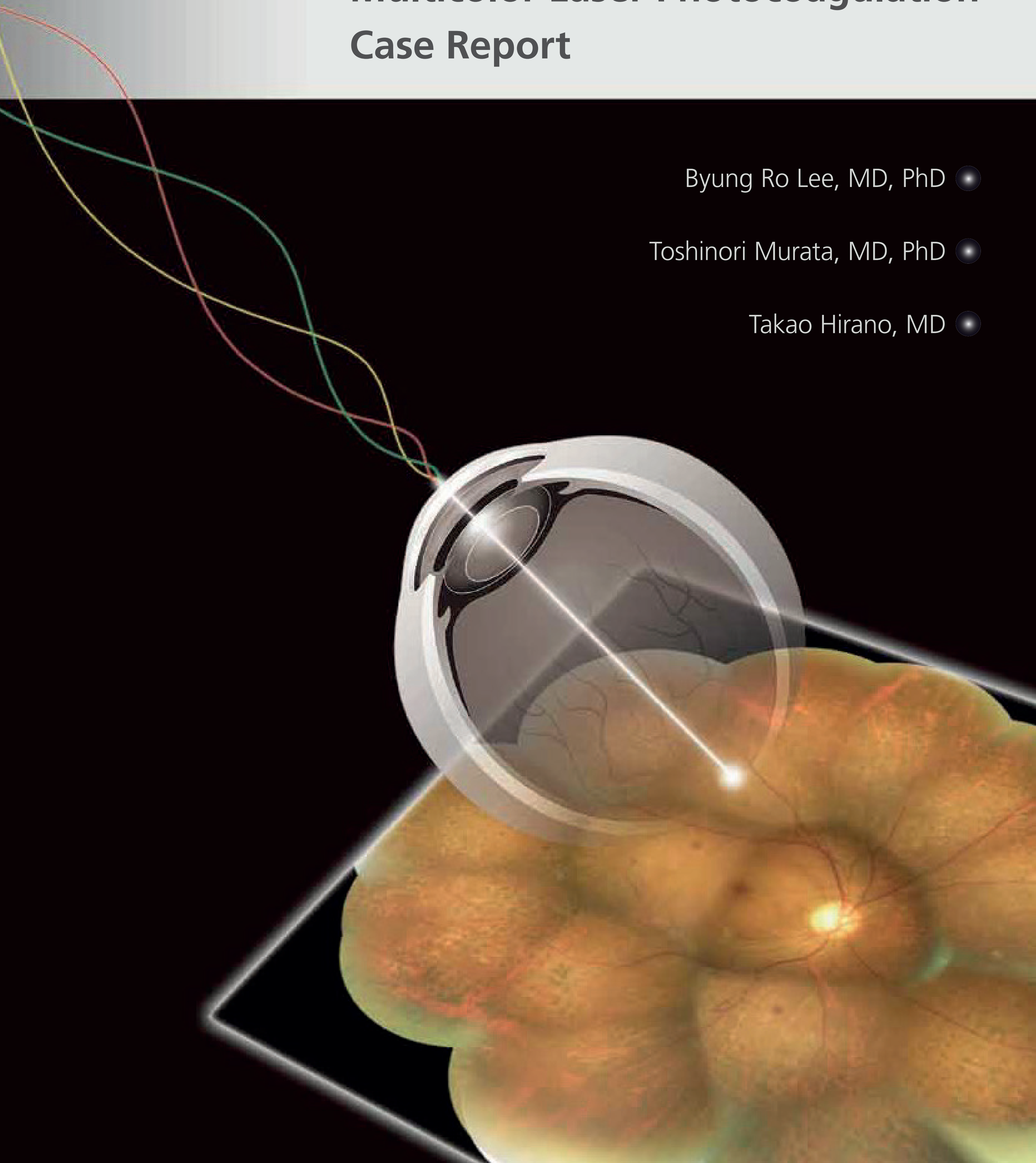
MC-500 Vixi

Multicolor Laser Photocoagulation Case Report

Byung Ro Lee, MD, PhD

Toshinori Murata, MD, PhD

Takao Hirano, MD



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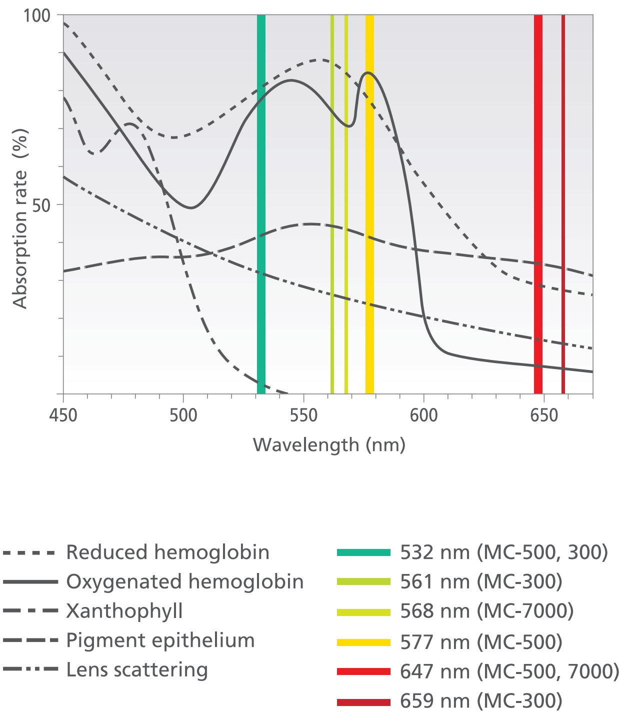
- The Ultimate Integration of Multicolor with Scan Laser

Laser Efficiency



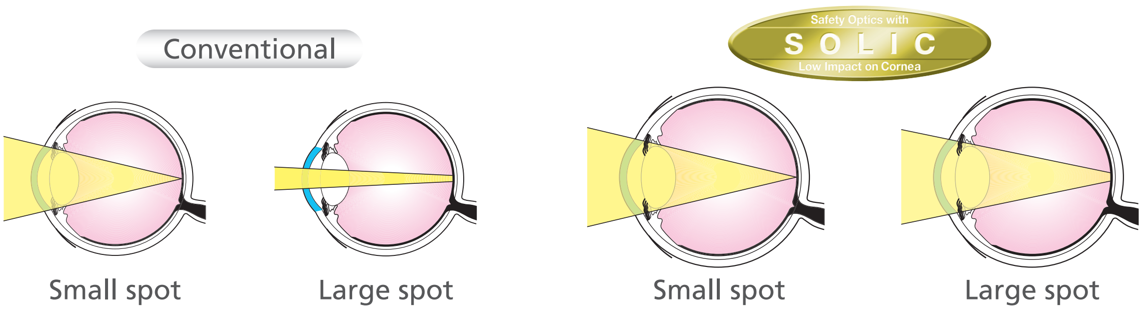
532 nm
The 532 nm (green) is the most common wavelength for treating retinal pathology.

577 nm
The 577 nm (yellow) laser is minimally absorbed by xanthophyll and is well absorbed by oxygenated hemoglobin compared to 561 nm and 568 nm lasers making it the wavelength of choice for lesions close to the macula. This wavelength has plentiful results achieved with the Dye lasers.

647 nm
The 647 nm (red) wavelength has been historically used in Krypton lasers. This wavelength is used for photocoagulation of deep choroidal pathology.

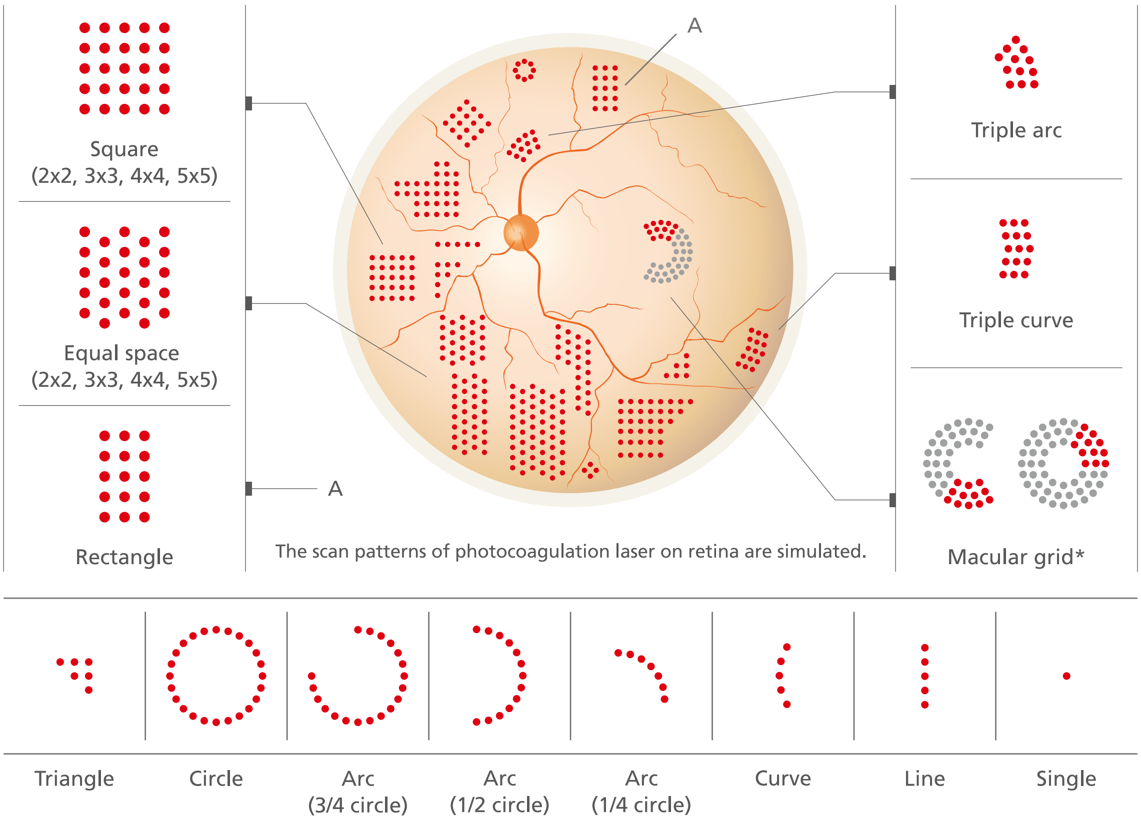
SOLIC (Safety Optics with Low Impact on Cornea)

All scan slit lamp and slit lamp delivery units including attachable models incorporate the SOLIC optical design that ensures low energy density on the cornea and lens even for large spot sizes.



Multiple Scan Patterns

The MC-500 Vixi has 22 preprogrammed scan patterns to allow treatment of varying retinal pathologies.

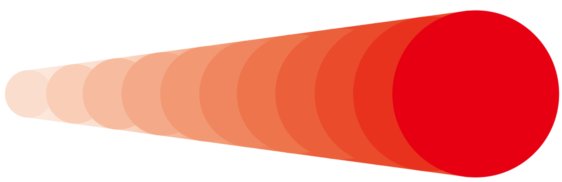


The scan patterns of photocoagulation laser on retina are simulated.

*The macular grid pattern is used for treatment of the periphery of macula in quadrants.
The inner diameter is fixed and spot sizes range from 100 to 200 μm.

Continuously Variable Spot Size

The scan spot size is continuously variable from 100 to 500 μm (50 to 500 μm in single mode).
The continuous variability enables the surgeon to easily compensate for the spot size change due to the use of a laser contact lens.



Why We Use Multicolor Scan Laser Photocoagulator

Byung Ro Lee, MD, PhD

The reason why I would like to use the multicolor pattern scanning laser is that MC-500 Vixi is very user-friendly, and the slit lamp has excellent optics.
Particularly, the yellow and red wavelength is more comfortable for patients than green, which means the patients tolerate the yellow and red light better.
Moreover, doctors feel much more comfortable when delivering the yellow or red pattern scanning laser because these induce quite less lenticular reflex than green pattern laser even in the case of significant cataract. In terms of safety, red laser with pattern scanning is ideal for the macula and is best when working very close to the fovea.
MC-500 Vixi allows surgery performed with a desired pattern. It almost makes laser delivery fun for the surgeon.

Toshinori Murata, MD, PhD / Takao Hirano, MD

The MC-500 Vixi is a novel multicolor laser photocoagulator with a pattern scan delivery system that dramatically reduces patient discomfort during panretinal photocoagulation (PRP). With the MC-500 Vixi, the severe pain typically caused by conventional laser photocoagulators is greatly reduced using short, high power laser pulses. Extended procedure times are also eliminated since the MC-500 Vixi pattern scan function can deliver multiple burns in a single shot.
In addition to a conventional green (532 nm) photocoagulation laser, the MC-500 Vixi comes newly equipped with yellow (577 nm), and red (647 nm) laser that are effective in treating diabetic eyes with opaque media, such as from cataracts or vitreous hemorrhage. These longer wavelength lasers have better transmission capacity through opaque media at lower coagulation power. The MC-500 Vixi thus minimizes the risk of retinal bleeding caused by short pulse coagulation.

Case
1

Early Proliferative Diabetic Retinopathy (PDR) with Non-Perfusion Area

58 -year-old male, OD, BCVA = 0.5, Asian

Laser contact lens	Quadraspheric (1.97x)	Power output	400 mW
Wavelength (color)	532 nm (green)	Emission time	0.02 second
Scan pattern	Square (4x4)	Shots	1540
Spot size	200 µm	Total energy	11 J
Spacing	0.75	Total surgery time	5 minutes

A 58-year-old man presented with uncontrolled type 1 diabetes with ocular complications. He was diagnosed with early proliferative diabetic retinopathy. The patient's fluorescein angiogram (FA) study demonstrated a leaking neovascularization with moderate degree of capillary nonperfusion on the midperipheral area (Fig. 1). Vision in his right eye was 100/200.

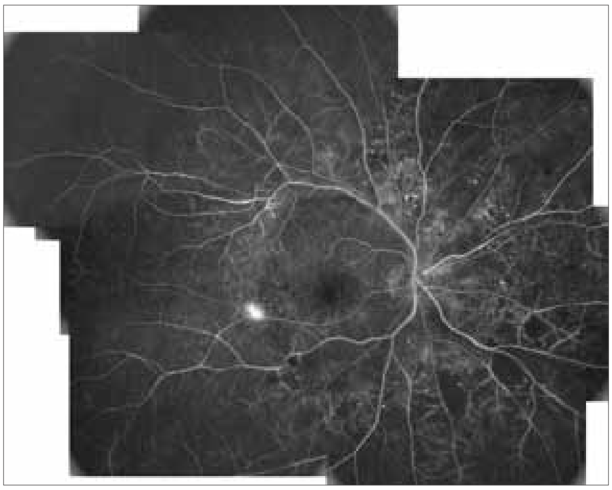


Fig. 1. FA before photocoagulation

Panretinal photocoagulation was performed using Green wavelength (532 nm) laser by MC-500 Vixi on the right eye the same day. The PRP procedure, which took about 5 minutes to perform, required no anesthesia. Approximately 1,500 laser spots were applied to the patient's right eye. Figure 2 shows the burns that were obtained using the 4x4 square array patterns with pulse duration set at 20 ms.

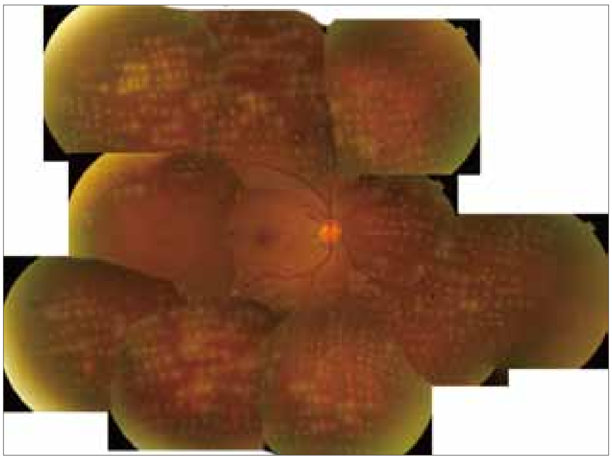


Fig. 2. Color fundus image after PRP
(immediately after laser treatment)

Photos courtesy of Prof. Lee, Hanyang University

Retromode images by F-10 show square array patterns burns on the whole fundus area, and OCT images by RS-3000 show multiple laser burns with several vertical bands of increased optical reflectivity within the outer retinal area (Fig. 3).

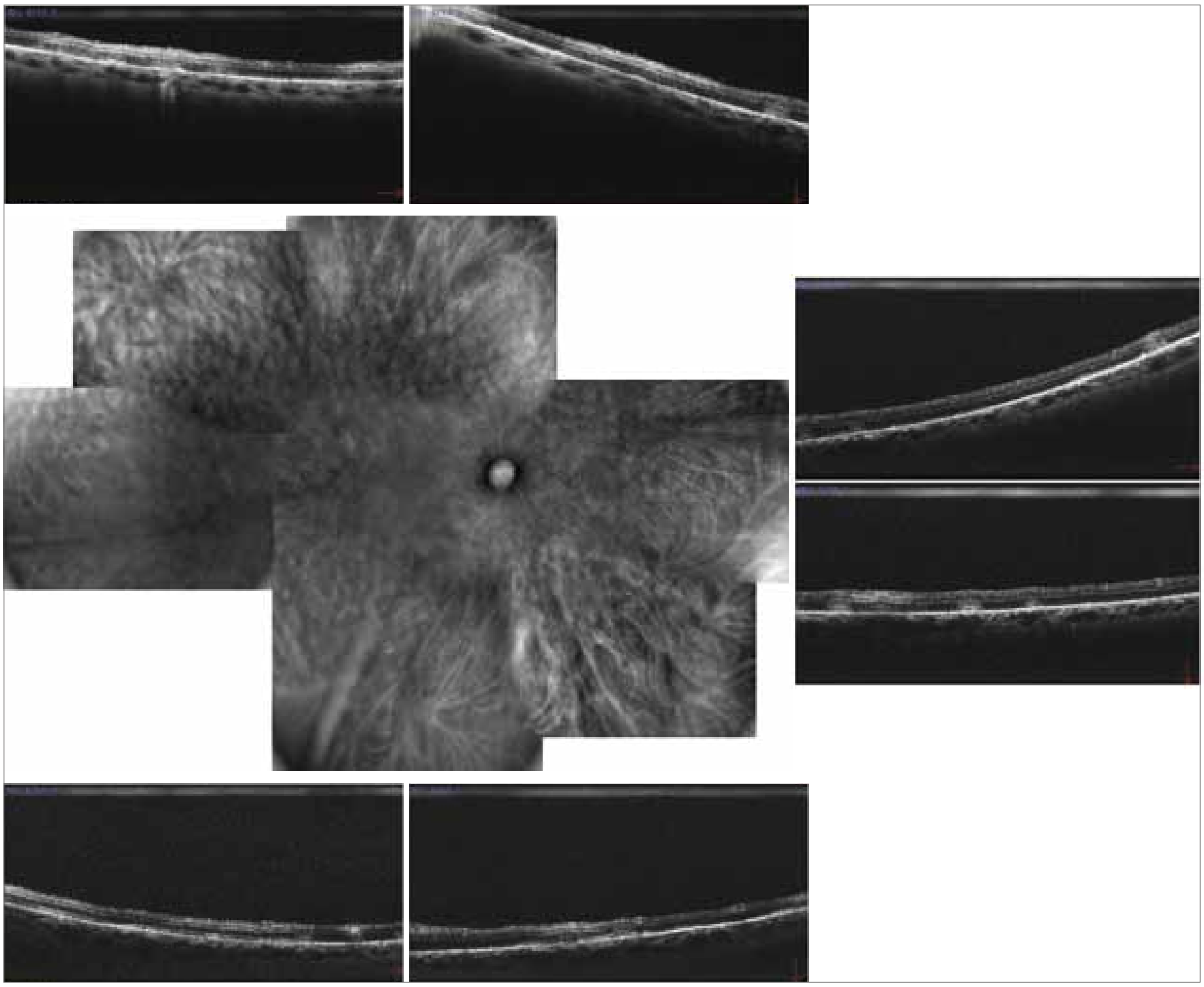


Fig. 3. Retromode Image by F-10 and OCT images after PRP (immediately after laser treatment)

Photos courtesy of Prof. Lee, Hanyang University

Case 2 Proliferative Diabetic Retinopathy (PDR)

58 -year-old male, OD, BCVA = 0.5, Asian

Laser contact lens	Mainster PRP 165 (1.96x)	Power output	300 - 450 mW 200 mW
Wavelength (color)	577 nm (yellow) 647 nm (red)	Emission time	0.02 second 0.2 second
Scan pattern	Square (2x2, 3x3, 4x4) Single	Shots	2598
Spot size	200 µm	Total energy	30.6 J
Spacing	0.5, 0.75, 1.0	Total surgery time	27 minutes

Fundus image shows intraretinal hemorrhage in each of the 4 quadrants, vitreous hemorrhage inferiorly, and proliferative tissue on the optic disc (Fig.1). Retinal non-perfusion areas and neovasculazation are detected by fluorescein angiography (FA) (Fig.2).

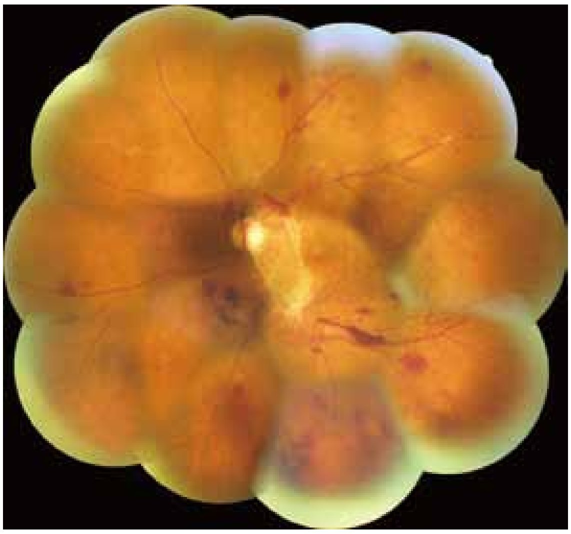


Fig. 1. Color fundus image before photocoagulation

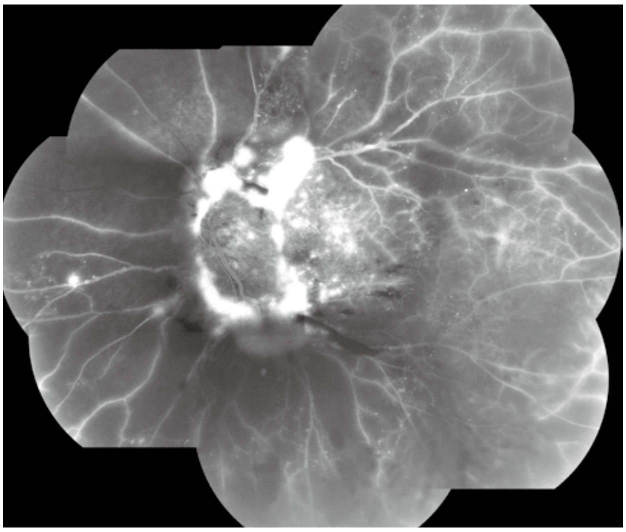


Fig. 2. FA before photocoagulation

Photos courtesy of Prof. Murata, Shinshu University

Optical coherence tomography (OCT) depicts macula edema by vitreous traction (Fig.3). Panretinal photocoagulation is completed using single and square patterns (Fig.4).

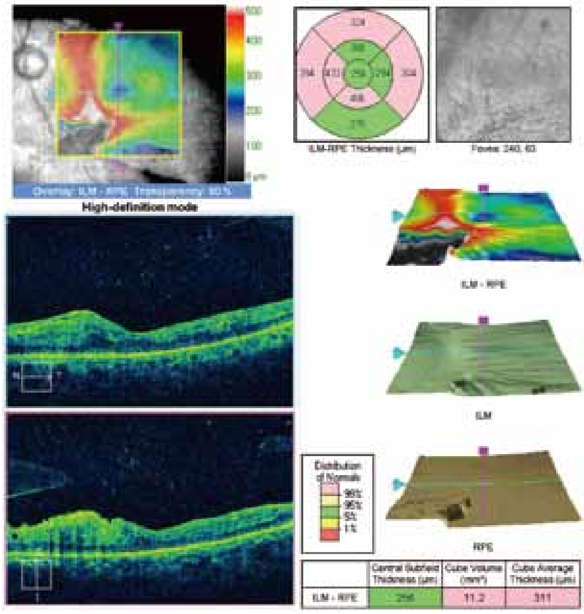


Fig. 3. OCT before photocoagulation

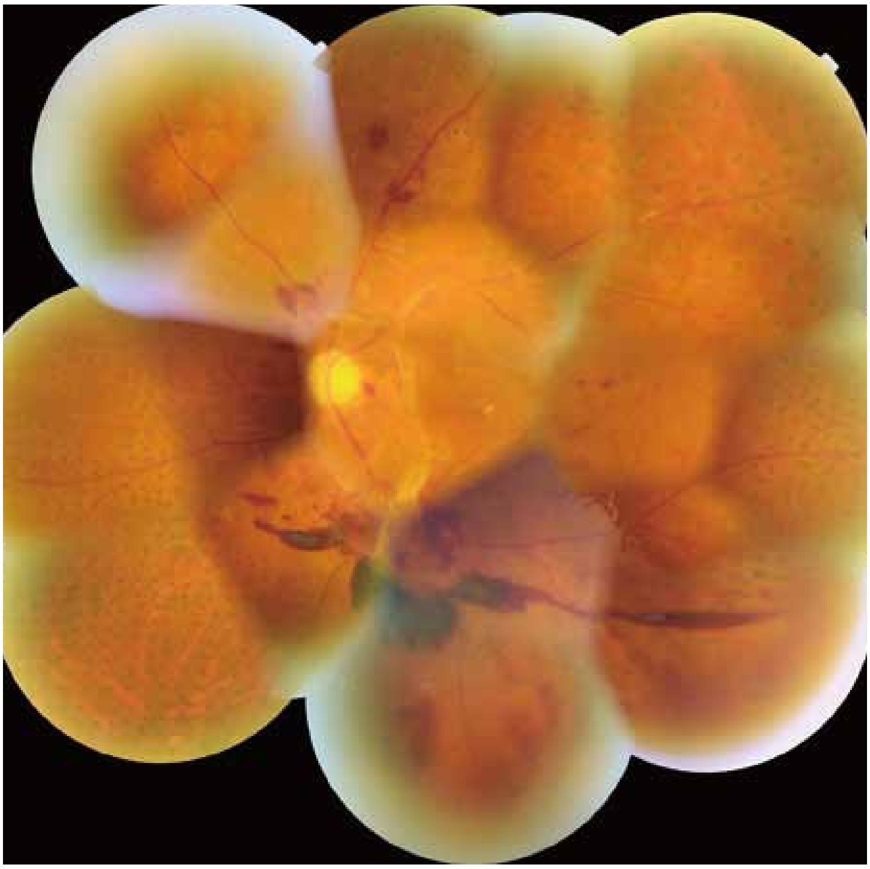


Fig. 4. Color fundus image after photocoagulation

Photos courtesy of Prof. Murata, Shinshu University

Case 3

Early Proliferative Diabetic Retinopathy (PDR)

43-year-old male, OS, BCVA = 0.5, Asian

Laser contact lens	Quadraspheric (1.97x)	Power output	390 mW
Wavelength (color)	577 nm (yellow)	Emission time	0.02 second
Scan pattern	Square (4x4)	Shots	1056
Spot size	200 µm	Total energy	8.5 J
Spacing	0.75	Total surgery time	5 minutes

A 43-year-old man with type 1 diabetes. He was diagnosed with early proliferative diabetic retinopathy in the left eye. Fluorescein angiogram (FA) demonstrated diffuse leakage with significant capillary nonperfusion on the peripheral area of the left eye (Fig. 1). Vision in his left eye was 100/200.

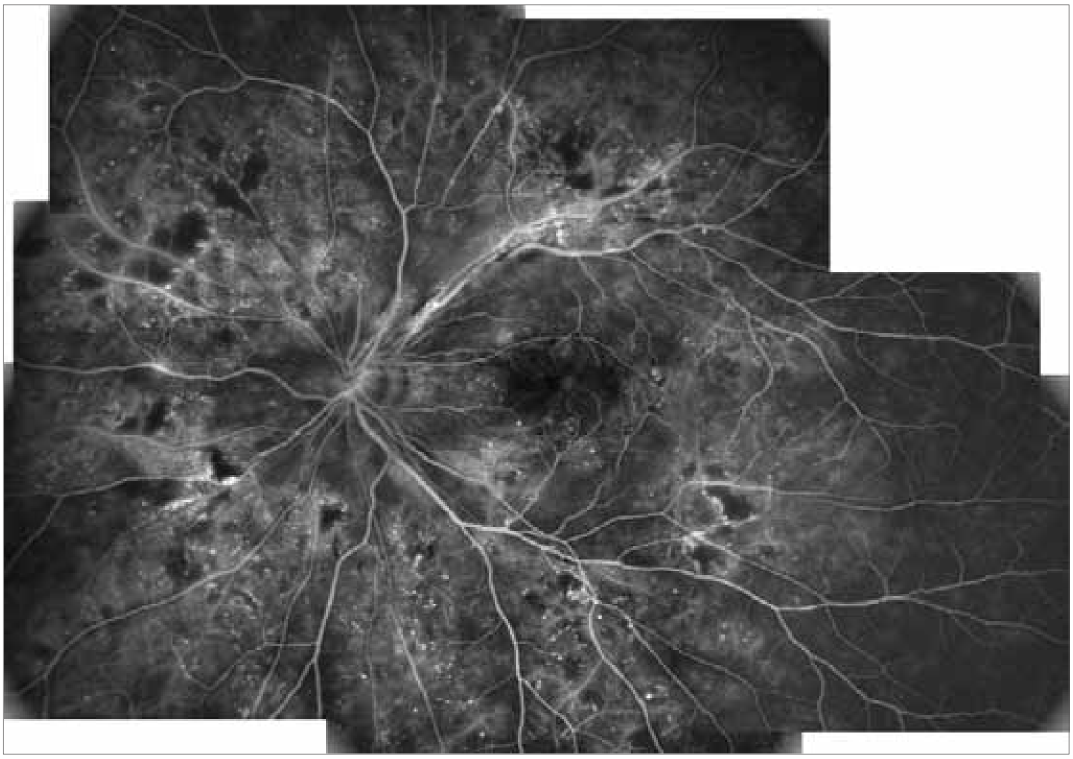


Fig. 1. FA before photocoagulation

Photo courtesy of Prof. Lee, Hanyang University

Panretinal photocoagulation was performed using yellow wavelength (577 nm) laser by MC-500 Vixi on the left eye. Laser burns obtained using the 4x4 square array patterns on each quadrants are shown on the red free images and the retromode images by F-10. Particularly, multiple laser burns with several vertical bands of increased optical reflectivity within outer retina are shown on OCT images by RS-3000 (Fig. 2).

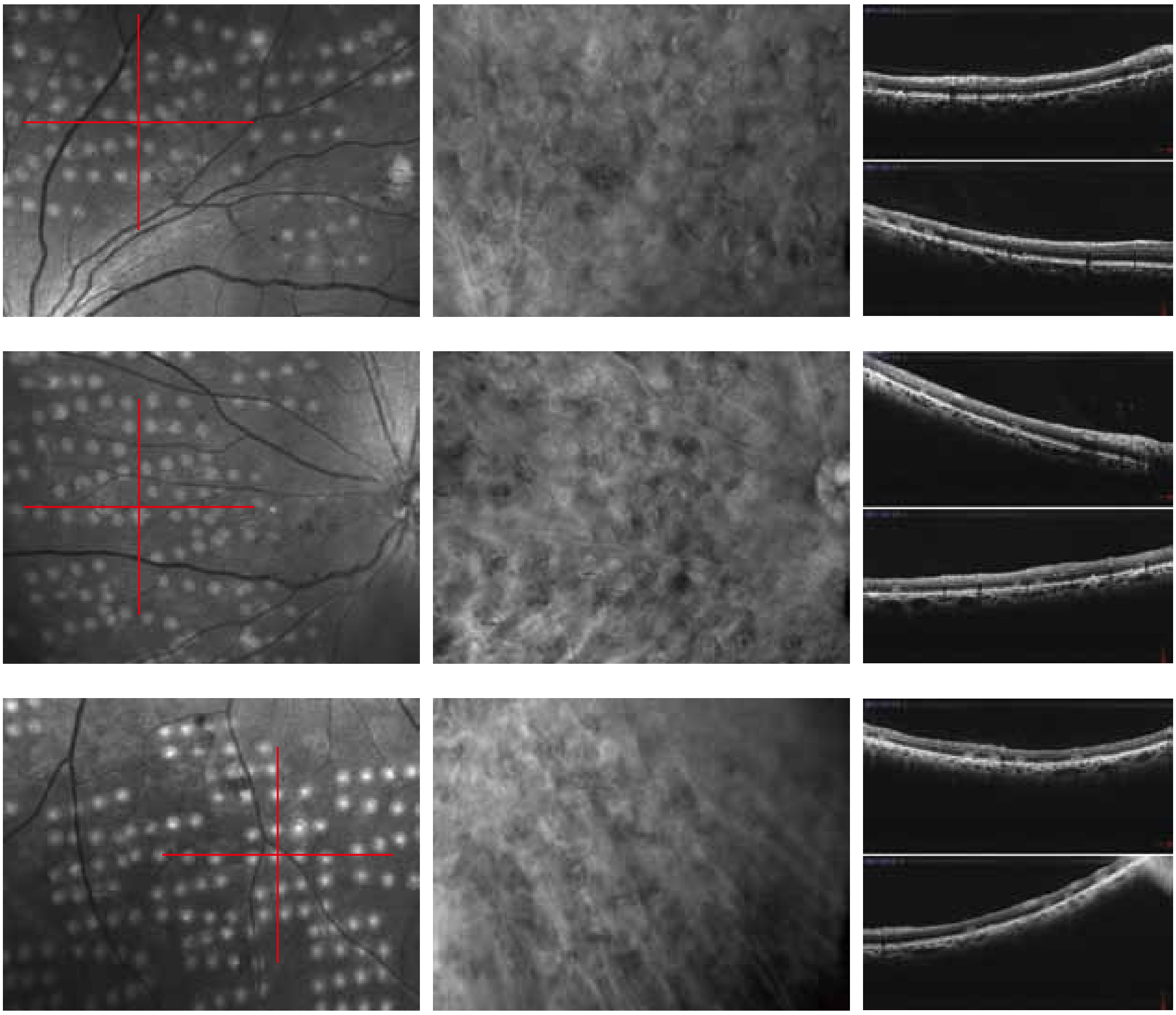


Fig. 2. Red-free images (left), Retromode images by F-10 (middle), and OCT images (right) immediately after PRP

Photos courtesy of Prof. Lee, Hanyang University

Case 3 ▸ Early Proliferative Diabetic Retinopathy (PDR)

6-months postoperative fundus images of the PRP laser shows significantly smaller size and decreased optical reflectivity of individual laser burns compared to fresh burns of the 1st operative day (Fig. 3).

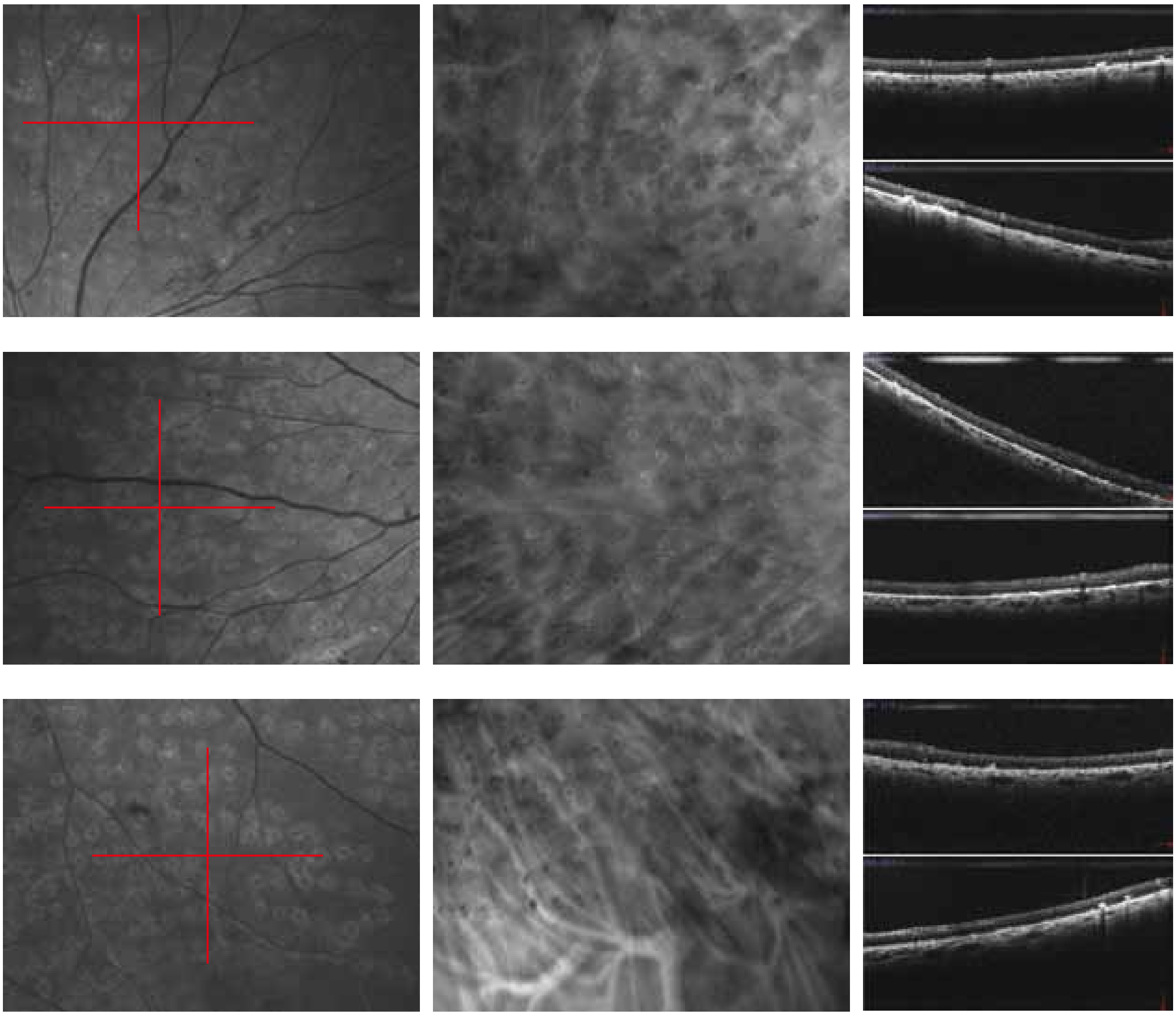


Fig. 3. Red-free images (left), Retromode images by F-10 (middle), and OCT images (right) 6 months after PRP

Photos courtesy of Prof. Lee, Hanyang University

Case
4

Severe Non-Proliferative Diabetic Retinopathy (NPDR)

45-year-old male, OD, BCVA = 1.5, Asian

Laser contact lens	Mainster PRP 165 (1.96x)	Power output	300 - 450 mW
Wavelength (color)	577 nm (yellow)	Emission time	0.02 second
Scan pattern	Square (2x2, 3x3, 4x4)	Shots	4772
Spot size	200 µm	Total energy	42.4 J
Spacing	0.5, 0.75	Total surgery time	24 minutes

Several diabetic retinopathy lesions are detected in the post pole (Fig.1) , but fluorescein angiography (FA) (Fig.2) shows definite venous beading and prominent intraretinal microvascular abnormalities.

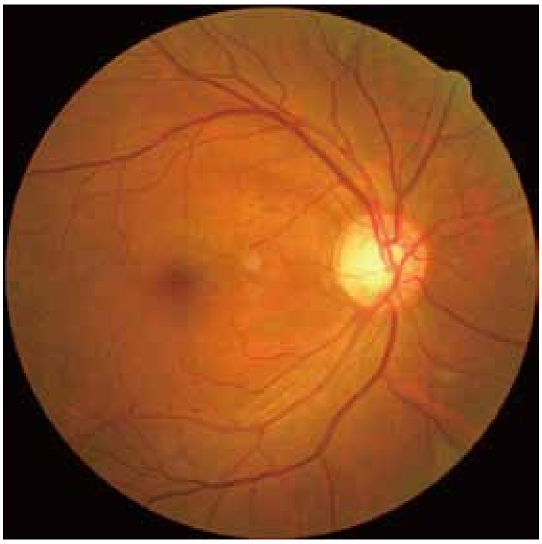


Fig. 1. Color fundus image before photocoagulation

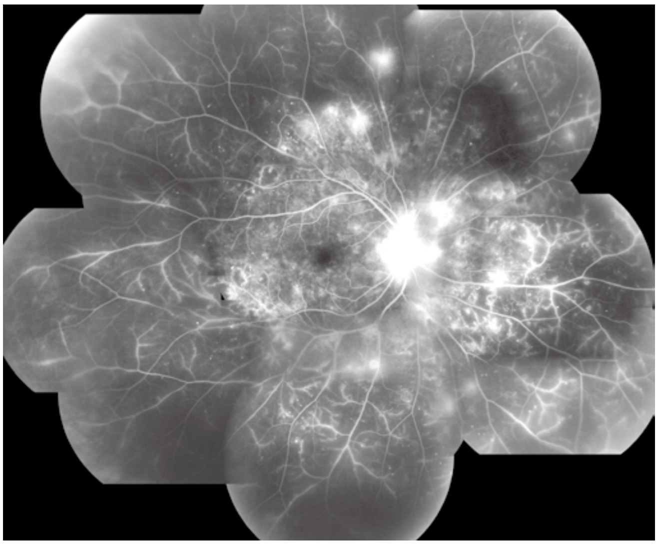


Fig. 2. FA before photocoagulation

Photos courtesy of Prof. Murata, Shinshu University

Case 4 ▸ Severe Non-Proliferative Diabetic Retinopathy (NPDR)

Fundus image (Fig.3) and FA (Fig.4) show orderly laser scars. Panretinal photocoagulation is completed without causing macula edema (Fig.5).

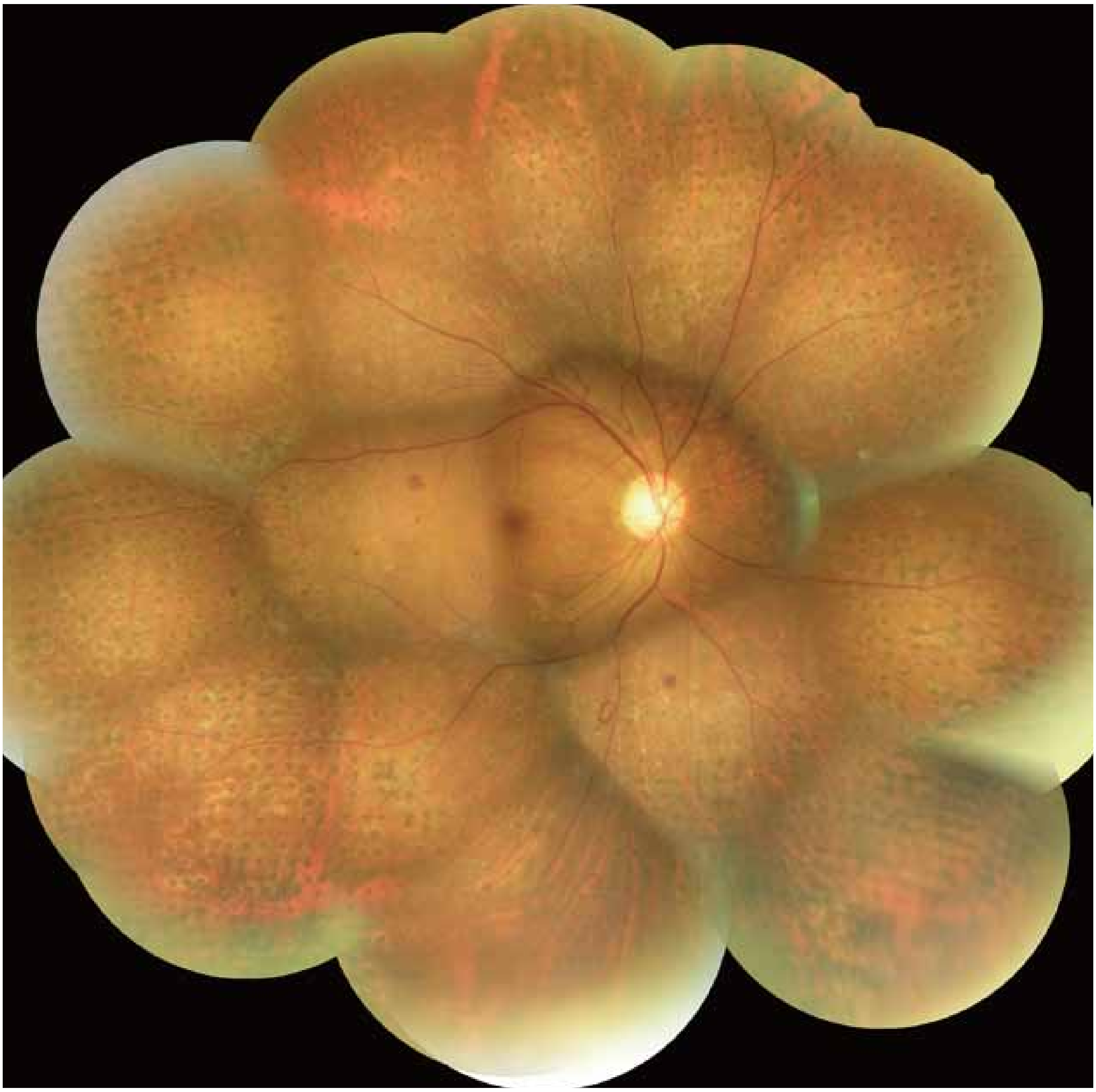


Fig. 3. Color fundus image after photocoagulation

Photo courtesy of Prof. Murata, Shinshu University

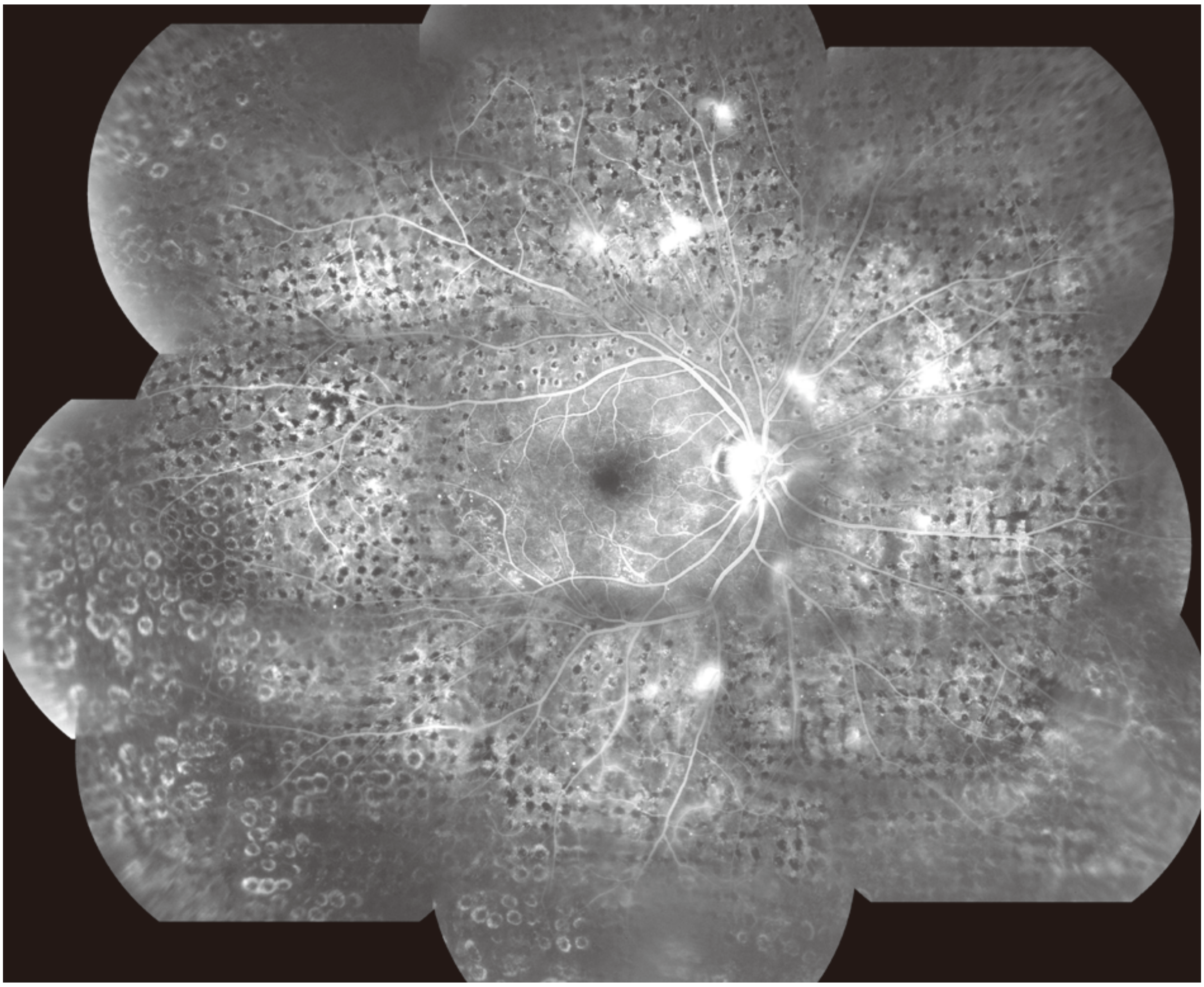


Fig. 4. FA after photocoagulation

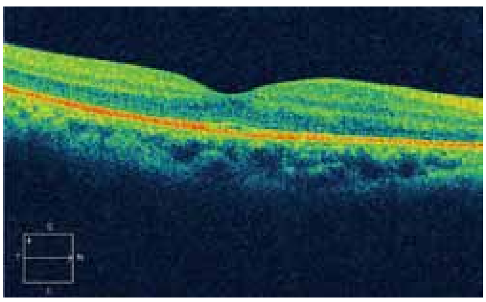


Fig. 5. OCT (cross-section) after photocoagulation

Photos courtesy of Prof. Murata, Shinshu University

Case 5 Very Severe Non-Proliferative Diabetic Retinopathy (NPDR) with Cataract

50-year-old male, OS, BCVA = 0.5, Asian

Laser contact lens	Quadraspheric (1.97x)	Power output	400 mW
Wavelength (color)	577 nm (yellow)	Emission time	0.02 second
Scan pattern	Square (5x5)	Shots	1270
Spot size	200 µm	Total energy	11.5 J
Spacing	0.75	Total surgery time	5 minutes

A 50-year-old diabetic man with moderate cataract in both eyes. He was diagnosed with very severe diabetic retinopathy on the left eye. Fluorescein angiogram (FA) demonstrated diffuse leakage with significant capillary nonperfusion on the peripheral area (Fig. 1). Vision in his left eye was 100/200.

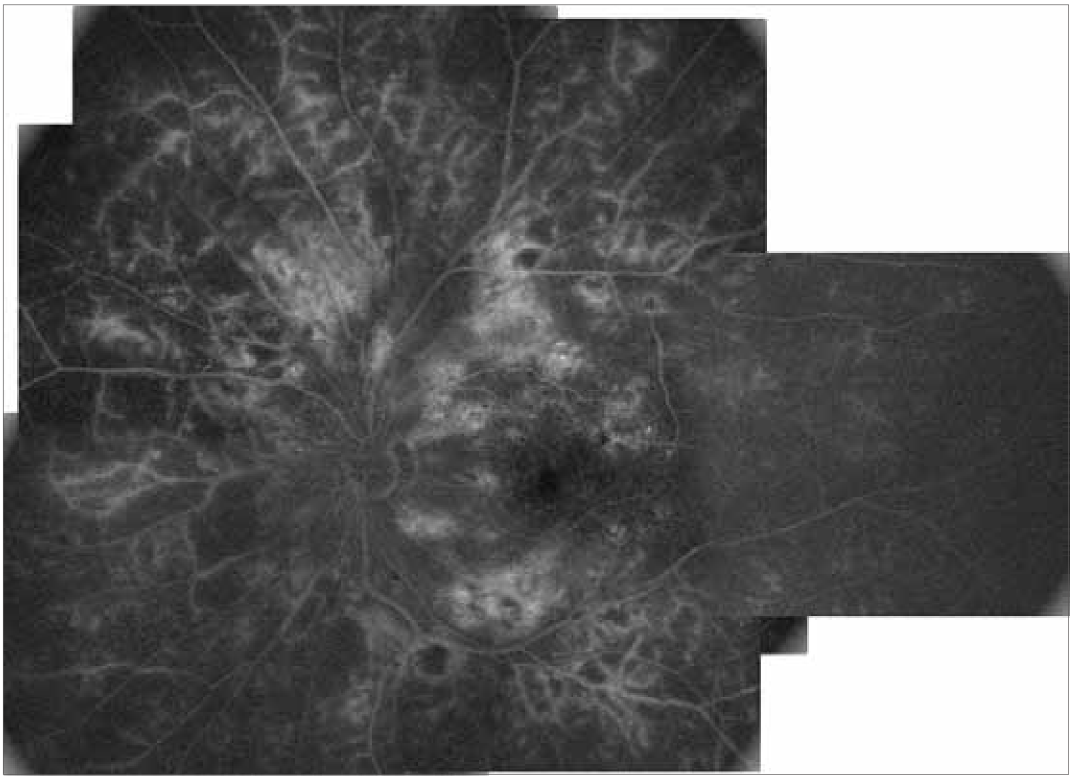


Fig. 1. FA before photocoagulation (noisy FA image due to cataract)

Photo courtesy of Prof. Lee, Hanyang University

Panretinal photocoagulation was performed using yellow wavelength (577 nm) laser by MC-500 Vixi on the left eye the same day. Total laser procedure took about 5 minutes to perform, and approximately 1,300 laser spots were applied to the left eye. Figure 2 shows the burns that were obtained using the 4x4 square array patterns on each quadrants on color fundus images, retromode images of F-10, and on B-scans of RS-3000.

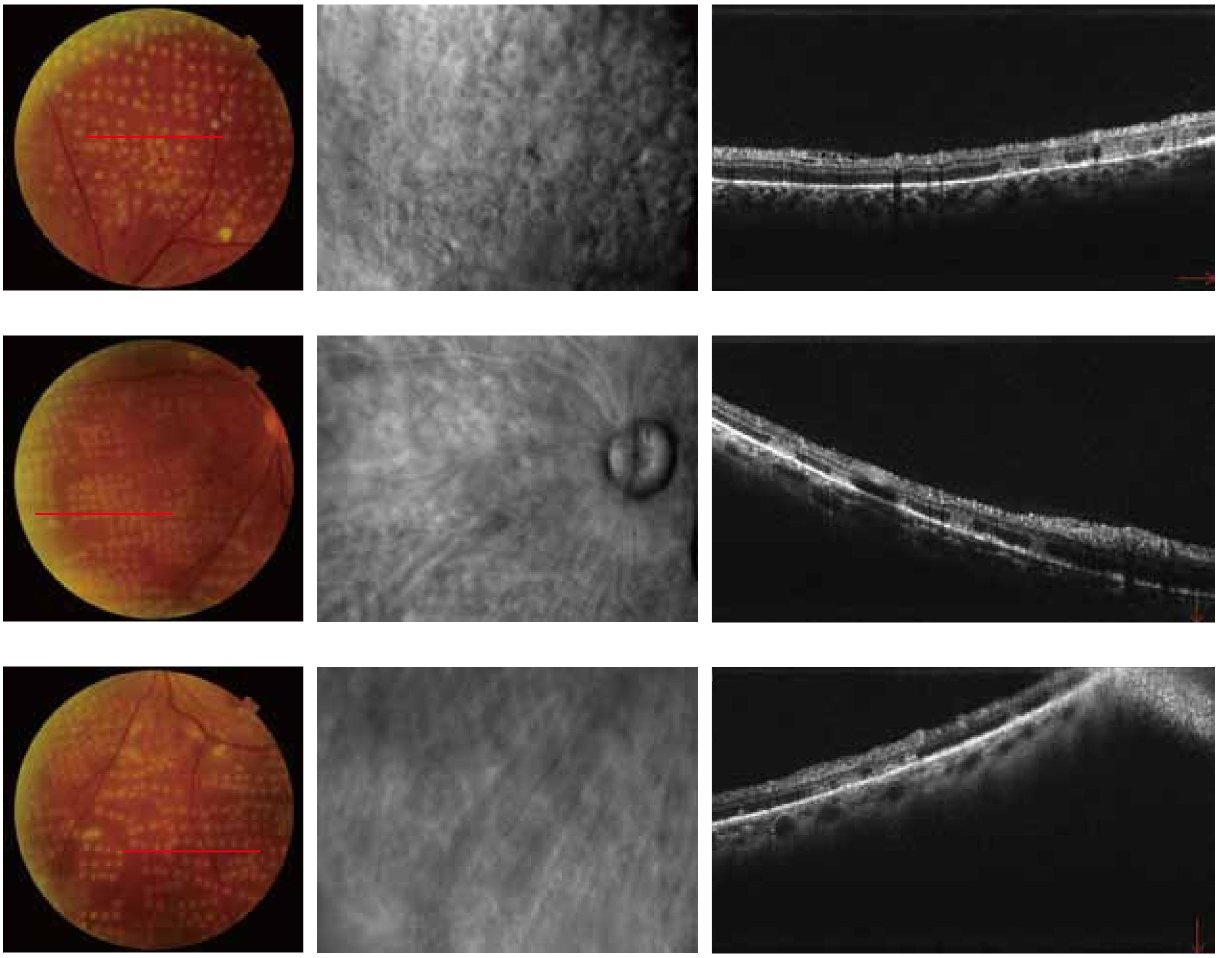


Fig. 2. Color fundus images (left), Retromode images by F-10 (middle), and OCT images (right) immediately after PRP

Photos courtesy of Prof. Lee, Hanyang University

Case 5 ▶ Very Severe Non-Proliferative Diabetic Retinopathy (NPDR) with Cataract

4-months postoperative fundus images and retromode images of the PRP status shows the pigmented spots of burns on each quadrant. Note significantly decreased optical reflectivity and smaller burn size compared to the burns immediately after laser treatment (Fig. 3).

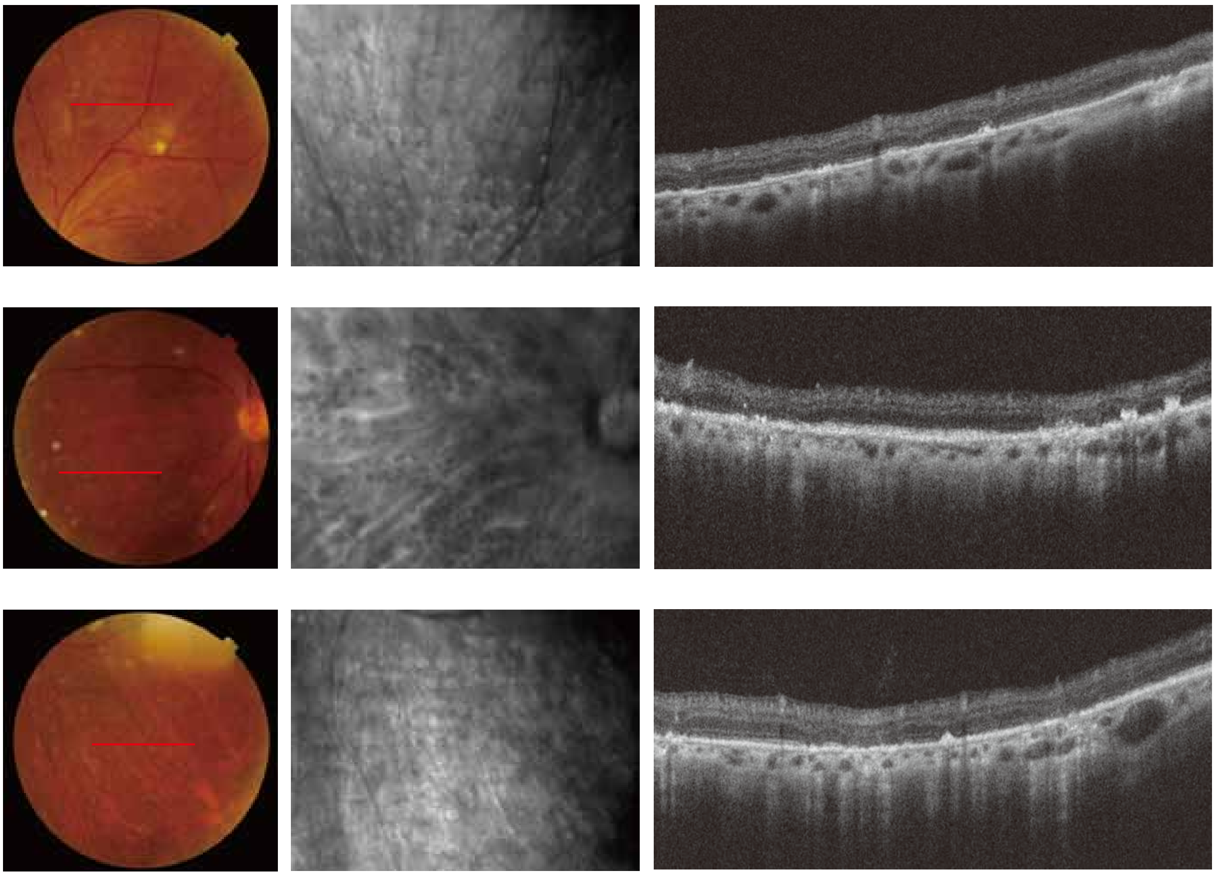


Fig. 3. Fundus images (left), Retromode images by F-10 (middle), and OCT images (right) 4 months after PRP

Photos courtesy of Prof. Lee, Hanyang University

Case 6 Diabetic Retinopathy (DR) with Successfully Laser Treated Clinically Significant Macula Edema

66-year-old male, OS, BCVA = 0.2 → 1.2, Asian

Laser contact lens	Area Centralis (0.94x)	Power output	150 mW
Wavelength (color)	577 nm (yellow)	Emission time	0.02 - 0.05 second
Scan pattern	Single	Shots	190
Spot size	50 µm	Total energy	1.1 J
Spacing	2	Total surgery time	2 minutes

Fundus image and optical coherence tomography (OCT) image show hard exudates at the macula involving the fovea (Fig.1, Fig.3-1). Macula map shows clinically significant macula edema (CSME) as a white and red region (Fig.3-2). Fluorescein angiography (FA) shows microaneurysms on the macula and previous panretinal photocoagulation (PRP) (Fig.2).

Fig. 1. Color fundus image before photocoagulation

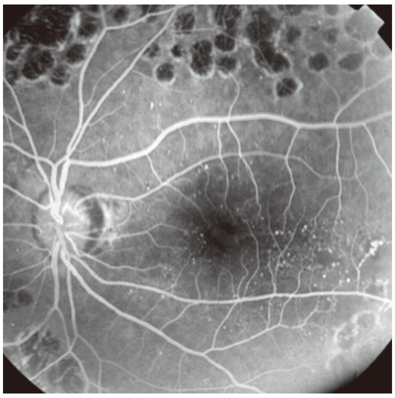
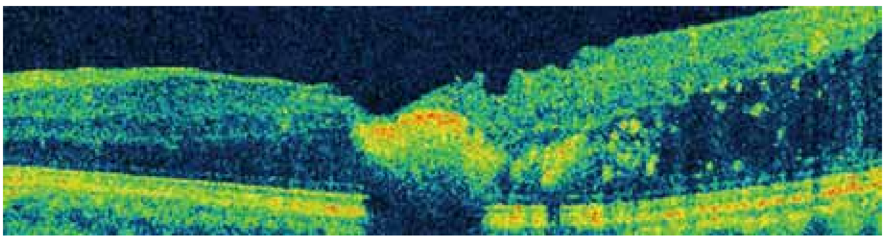


Fig. 2. FA before photocoagulation

Fig. 4. Color fundus image immediately after the grid and focal photocoagulation



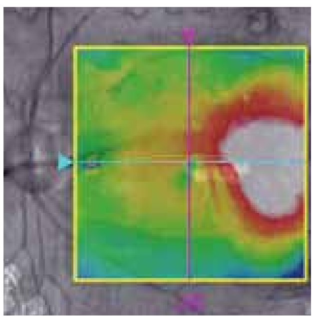


Fig. 3-1 (left). OCT (Cross-section) before photocoagulation
Fig. 3-2 (right). OCT (Macula map)

Photos courtesy of Prof. Murata, Shinshu University

Case 6 ▸ Diabetic Retinopathy (DR) with Successfully Laser Treated Clinically Significant Macula Edema

Fundus image (Fig.4) and FA (Fig.6) show recent laser scars. This type of treatment is called "grid and focal" photocoagulation. Fundus image (Fig.5) and OCT (Fig.7-1) show decreased hard exudates 1 year after grid and focal photocoagulation. Macula map (Fig.7-2) shows diminished CSME.

Fig. 5. Color fundus image 1 year after the grid and focal photocoagulation

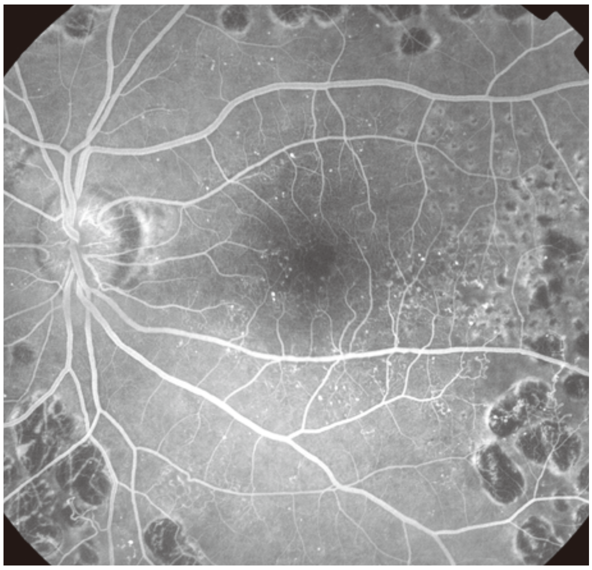
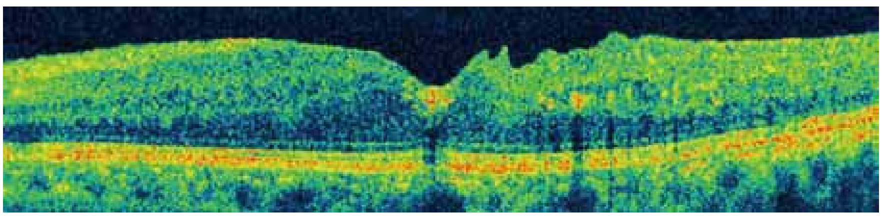


Fig. 6. FA immediately after the grid and focal photocoagulation



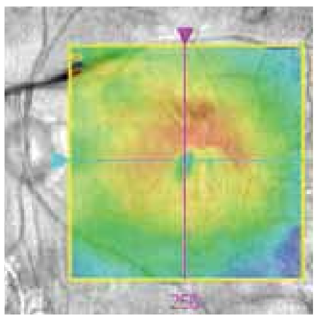


Fig. 7-1 (left). OCT (Cross-section) 1 year after the grid and focal photocoagulation
Fig. 7-2 (right). OCT (Macula map) 1 year after the grid and focal photocoagulation

Photos courtesy of Prof. Murata, Shinshu University

Case 7

Branch Retinal Vein Occlusion (BRVO) with New Vessel

71-year-old female, OS, BCVA = 0.15, Asian

Laser contact lens	Quadraspheric (1.97x)
Wavelength (color)	577 nm (yellow)
Scan pattern	Square (4x4)
Spot size	200 µm
Spacing	0.75

Power output	250 mW
Emission time	0.02 second
Shots	706
Total energy	5.8 J
Total surgery time	4 minutes

A 71-year-old woman presented with branch retinal vein occlusion in the left eye. Vision in her left eye was 30/200. Fluorescein angiogram (FA) demonstrated significant capillary nonperfusion with neovascularization on the superior temporal area (Fig. 1).

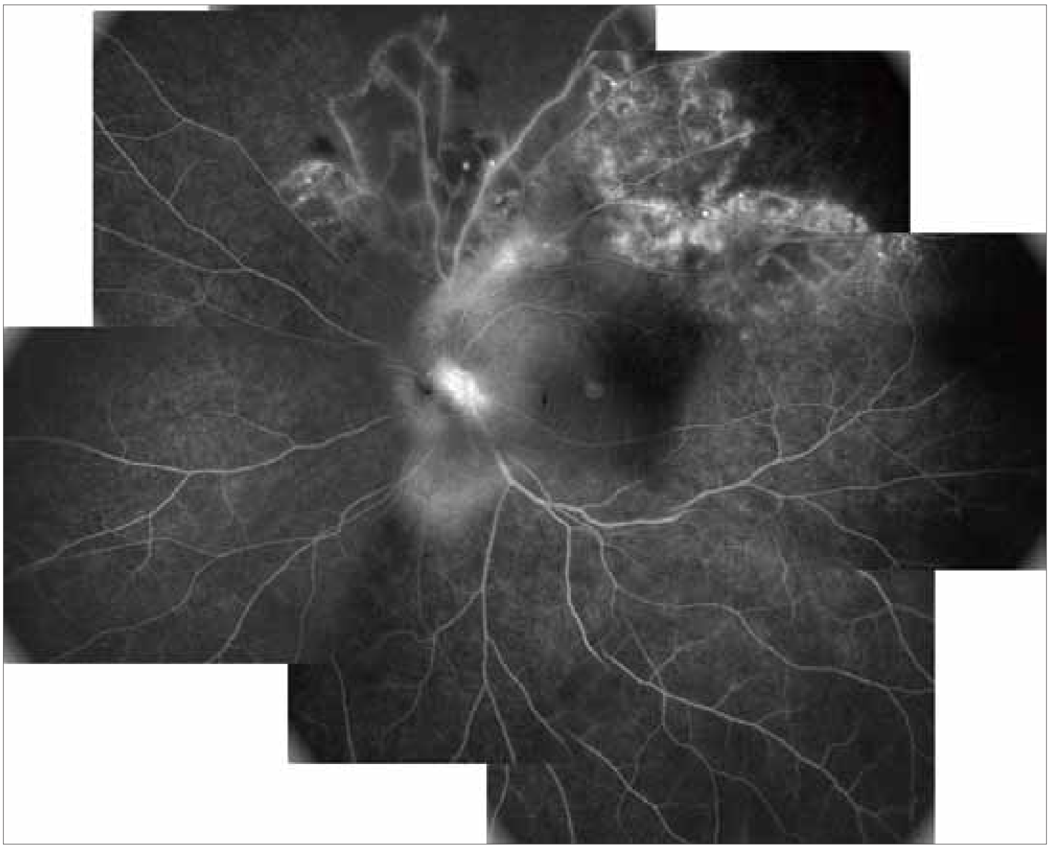


Fig. 1. FA before photocoagulation

Photo courtesy of Prof. Lee, Hanyang University

Case 7 ▸ Branch Retinal Vein Occlusion (BRVO) with New Vessel

Sectoral scattered laser using yellow wavelength (577 nm) laser by MC-500 Vixi was done on the superior temporal area, which is clearly visible on fundus image and retromode image by F-10. Multiple laser burns with several vertical bands of increased optical reflectivity are clearly seen on B-scans of RS-3000 (Fig. 2).

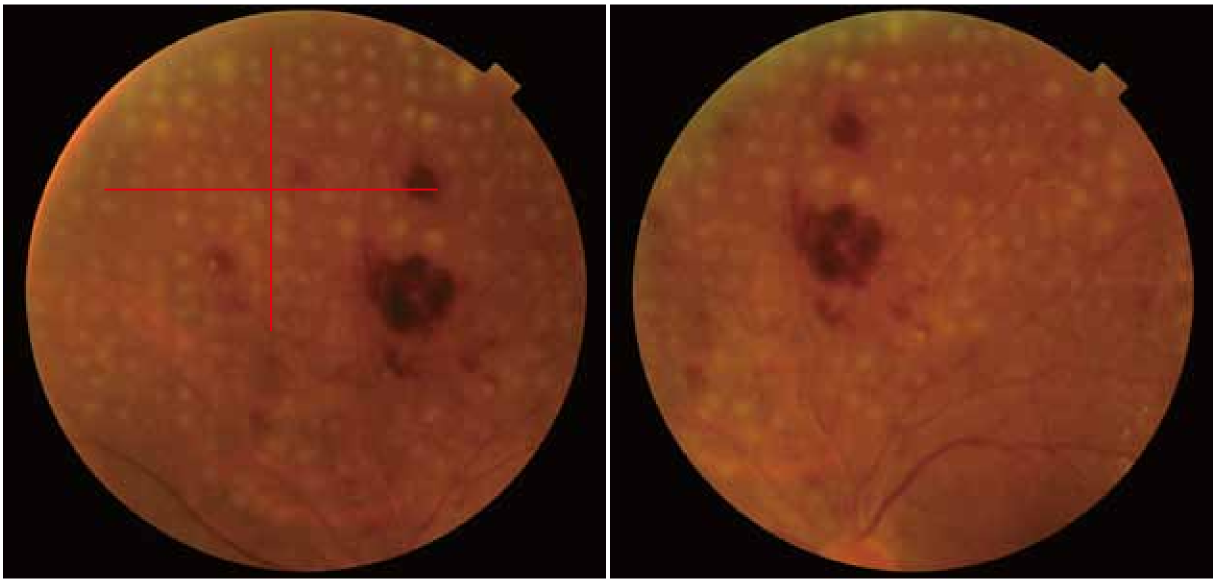
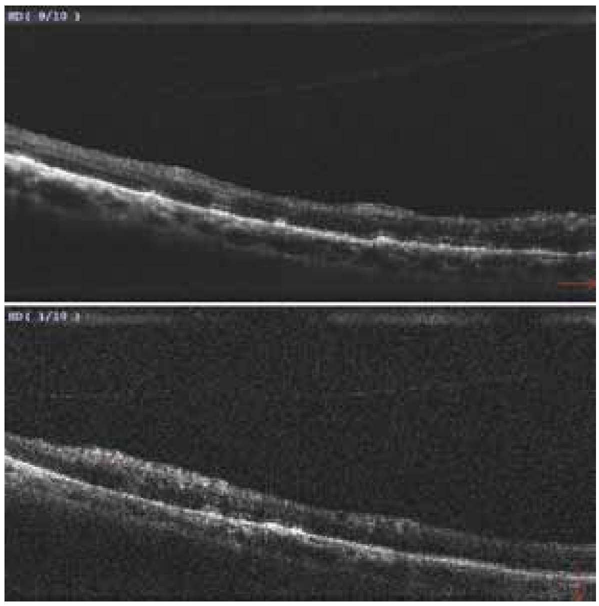
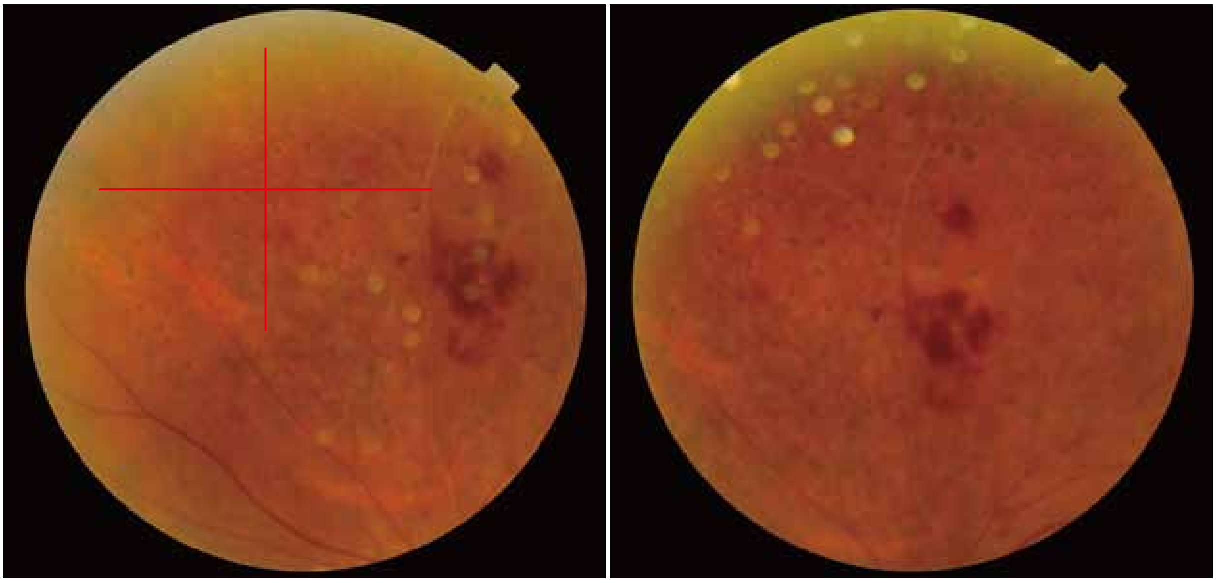


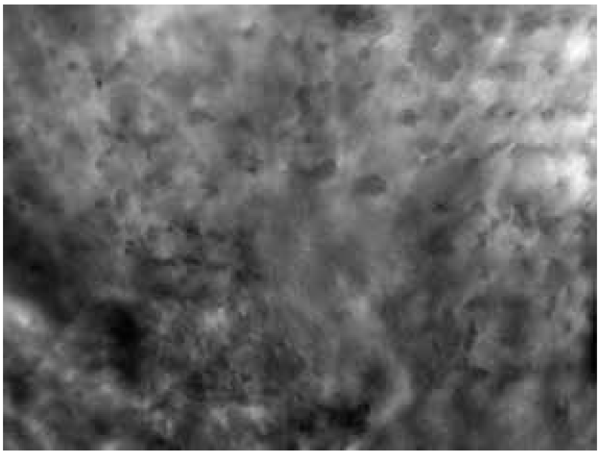
Fig. 2. Color fundus images (top), Retromode image by F-10 (bottom left), and OCT images (bottom right) immediately after sectoral photocoagulation



Photos courtesy of Prof. Lee, Hanyang University

2-months postoperative fundus images of the PRP laser, show the pigmented spots of burns that were obtained using the 4x4 square array patterns. Note significantly decreased optical reflectivity of individual laser burns with smaller size of burn diameter comparing to fresh burns of the 1st operative day (Fig. 3).





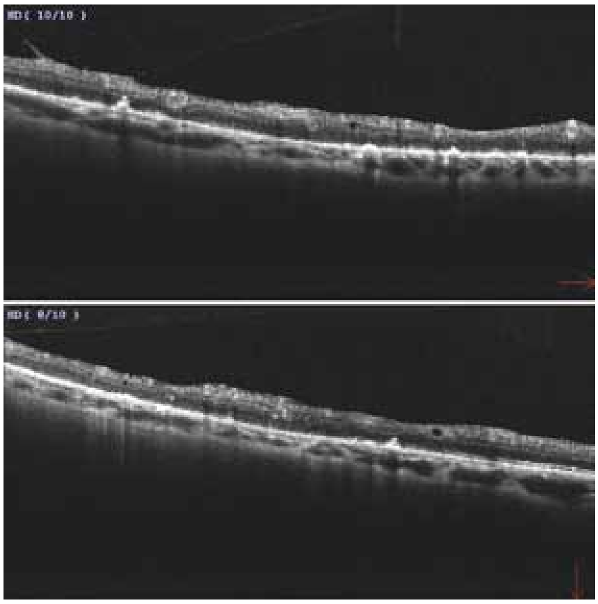


Fig. 3. Color fundus images (top), Retromode image by F-10 (bottom left), and OCT images (bottom right) 2 months after sectoral photocoagulation

Photos courtesy of Prof. Lee, Hanyang University

Case
8

Retinal Breaks

46-year-old male, OS, BCVA = 1.2, Asian

Laser contact lens	Mainster PRP 165 (1.94x)	Power output	300 mW
Wavelength (color)	577 nm (yellow)	Emission time	0.02 second
Scan pattern	Circle (900 µm, 1200 µm, 1500 µm) Curve (30°, 150 °, 270°)	Shots	360
Spot size	200 µm	Total energy	2.2 J
Spacing	0.5, 0.75, 1.0	Total surgery time	4 minutes

Fundus image (Fig.1) shows retinal breaks in the peripheral retina without retinal detachment. Fundus image (Fig.2) shows retinal breaks surrounded by laser burns. After 1 month, retinal breaks are surrounded by laser scars. Retinal detachment is not detectable.

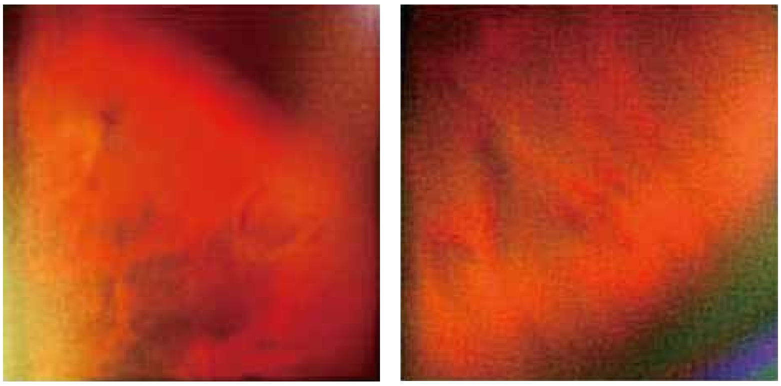


Fig. 1. Color fundus image before photocoagulation

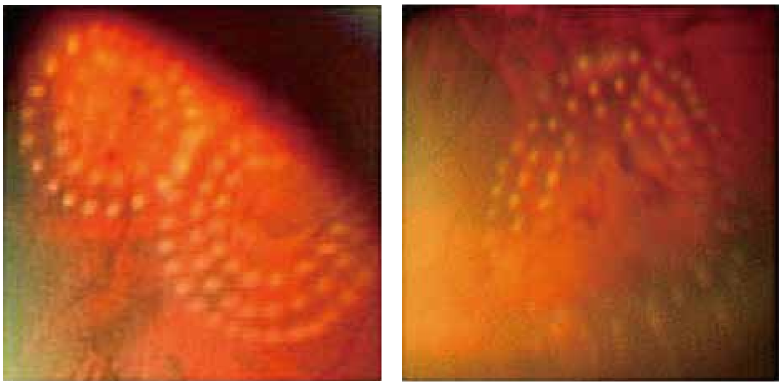


Fig. 2. Color fundus image immediately after photocoagulation

Photos courtesy of Prof. Murata, Shinshu University

Disclaimer

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Authors

Byung Ro Lee, MD, PhD

Professor and Chairman, Department of Ophthalmology,Hanyang University, Korea

Dr. Byung Ro Lee is Professor and Chair of the Hanyang University Department of Ophthalmology, Seoul, Korea. Dr. Lee obtained his M.D. (1986) and Ph.D. (1998) in Medicine from Hanyang University, Seoul,Korea. He completed his residency in ophthalmology at Hanyang University Hospital and his retina research fellowship at Doheny Eye Institute, University of Southern California (1996-1997). He served as a visiting scholar at Jacobs Retina Center, the University of California, San Diego (2006-2007).
His chief clinical interests include age-related macular degeneration, diabetic retinopathy, retinal detachment, uveitis, and other important retinal diseases. In his research, Dr. Lee focuses on novel diagnostic imaging techniques and image analysis of vitreoretinal structures, vitreoretinal surgery, and retinal pharmacology.
Dr. Lee has published or co-authored many peer-reviewed manuscriptsin various ophthalmology journals. He won the Rhett Buckler Awardfrom the American Society of Retinal Specialists, 2008.

Toshinori Murata, MD, PhD

*Professor and Chairman, Department of Ophthalmology,School of Medicine,
Shinshu University, Japan*

Dr. Toshinori Murata is Professor and Chairman of the Department of Ophthalmology, at Shinshu University School of Medicine in Matsumoto, Japan. He was a Research Associate in the Doheny Eye Institute at the University of Southern California in Los Angeles, California, from 1996 to 1998, where he received the Postdoctoral Fellowship Award from the Juvenile Diabetes Research Foundation for his research on the causative role of vascular endothelial growth factor (VEGF) in diabetic macular edema in 1998. He continued his research work at Harvard University from 1998 to 1999. Professor Murata is a currently well-known vitreo-retinal surgeon in Japan whose findings are now directly utilized all over the world in the treatment of patients with diabetic retinopathy and age-related macular degeneration, in which VEGF plays a critical role. His research work has been summarized in the “Choroidal Neovascularization” chapter in the fourth edition of RETINA, published in 2006.

Takao Hirano, MD

Clinical Advisor, Department of Ophthalmology, School of Medicine, Shinshu University, Japan

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