Published in final edited form as:

J Glaucoma. 2010 August ; 19(6): 349–355. doi:10.1097/IJG.0b013e3181bd59c.

Three-Dimensional High-Speed Optical Coherence Tomography for Diagnosis of Hypotony Maculopathy Following Glaucoma Filtration Surgery

Margot L. Goodkin, MD PhD, Dilraj S Grewal, MD, and David S. Greenfield, MD

From the Department of Ophthalmology, University of Miami Miller School of Medicine, Bascom Palmer Eye Institute, Palm Beach Gardens, FL

Abstract

Purpose—To describe the clinical findings of hypotony maculopathy using three dimensional (3D) topography maps reconstructed from spectral domain optical coherence tomography (SD-OCT) imaging, and compare SD-OCT with time domain OCT (TD-OCT) for hypotony maculopathy diagnosis.

Methods—This was an observational non-comparative case series comprising of seven patients with hypotony maculopathy following trabeculectomy with mitomycin C. All patients underwent consecutive imaging with TD-OCT (Stratus OCT) and SD-OCT using various high-resolution instruments. 3D surface maps obtained using SD-OCT were compared to linear scans obtained using TD-OCT.

Results—Two of 7 eyes had minimally detectable folds with TD-OCT imaging in the vertical axis. Five eyes did not show folds on TD-OCT. 3D topographic maps using SD-OCT demonstrated advanced retinal and subretinal folds throughout the macular region in all 7 patients. All eyes (4 cases) with no topographically detectable folds using SD-OCT within the foveal avascular zone had visual acuity of 20/25 or better. Three eyes with obvious contour disruption within the foveal pit had visual acuity ranging from 20/30 to 20/70.

Conclusions—SD-OCT using 3D surface topography mapping provides greater sensitivity for hypotony maculopathy diagnosis and monitoring as compared with TD-OCT. Disruption of the foveal pit as detected using SD-OCT is associated with reduced visual acuity.

INTRODUCTION

Hypotony maculopathy is a well-described complication following glaucoma filtering surgery. Clinical features that characterize this syndrome include optic disc edema, venous tortuosity, and radial chorioretinal folds due to contraction of elastic sclera.^{1, 2} Pederson has described “statistical” hypotony as an intraocular pressure (IOP) less than 6.5 mm Hg, corresponding to more than three standard deviations below the mean,^{3–5} while Schubert explains “clinical hypotony” as a low pressure that leads to changes in ocular function and tissue structure over time.⁶ Although many eyes tolerate low IOP, ocular hypotony is an important cause of visual loss following glaucoma surgery.

Corresponding Author: David S. Greenfield, MD, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, 7101 Fairway Drive, Palm Beach Gardens, FL 33418, USA. Phone: (561) 515-1513; Fax: (561) 355-8616; dgreenfield@med.miami.edu.

Conflict of Interest: The authors have no financial interest in any device or technique described in this paper. Dr. Greenfield has received research support and has served as a consultant for Carl Zeiss Meditec, Optovue, Inc, and Topcon Medical Systems, Inc.

Previous studies have indicated that risk factors for development of hypotony maculopathy include young age, male gender, myopia, primary filtering surgery, and use of antifibrotic agents during surgery.^{3, 5, 7} Although it has been theorized that increased central corneal thickness may produce overestimation of measured Goldmann applanation IOP and predispose to hypotony maculopathy, a recent study demonstrated no relationship.⁸ The term, “hypotony maculopathy”, first coined by Gass in 1972², described wrinkling or folding of the choroid and/or retina in the posterior pole associated with visual loss occurring at a low intraocular pressure.^{3, 5, 6} Gass theorized that the structural changes were caused by thickening of the perifoveal sclera wall and choroid, causing the thicker perifoveal retina surrounding the thinner foveal retina to become displaced centrally, throwing the tissue into radial folds. These chorioretinal folds are usually particularly evident in the macula. The incidence of hypotony maculopathy has risen since the introduction of adjunctive use of antifibrotic agents in glaucoma surgery in the early 1990’s, particularly the use of Mitomycin-C.^{3, 5–7} The frequency of both chronic hypotony and hypotony maculopathy has increased, with the occurrence ranging from 3% to 20% in various series.^{3, 6, 9} Some studies have suggested that high concentrations of, or prolonged exposure to Mitomycin- C may be associated with the development of maculopathy.^{7, 10} Timely recognition of hypotony maculopathy in post-operative patients with vision loss or decrease is important for restoration of visual function.

Hypotonous changes in the macula may be subtle, and can be difficult to discern on fundusoscopic examination. Time domain optical coherence tomography (TD-OCT) has been demonstrated to facilitate the diagnosis of suspected hypotony maculopathy in patients with reduced visual acuity and low intraocular pressure.^{11–13} Radial macular scans using TD-OCT in hypotonous eyes may illustrate an irregular contour of the retina and choroid in patients with low IOP consistent with folds. Recent technological advances have emerged that enable more precise identification and quantification of posterior segment pathology involving the macula and optic nerve. Spectral domain OCT (SD-OCT) provides significantly increased scanning speed and resolution^{14–16} that permits high-density raster scanning of retinal tissue and reduction of ocular motion artifact.^{15, 17} The technology transforms the optical spectrum into electrical signals after image acquisition. SD-OCT uses fast Fourier transformation of collected frequencies to improve the signal to noise ratio and registers the B-scan view with the en face view of the retinal surface. Three-dimensional assessments of the retina and optic nerve are obtainable with axial resolution of approximately 5 microns over a maximum scan area of 6 × 6 mm.

We hypothesized that topographic maps obtained with SD-OCT may enhance detection of macular folds in eyes with ocular hypotony following glaucoma surgery. The purpose of the present study is to describe the clinical findings of hypotony maculopathy using three dimensional (3D) topography maps reconstructed from SD-OCT imaging, and compare SD-OCT with TD-OCT for hypotony maculopathy diagnosis.

MATERIAL AND METHODS

This was a non-randomized, observational cohort study involving glaucomatous subjects at a single institution who developed hypotony maculopathy as a consequence of glaucoma surgery. All participants signed a consent form approved by the Institutional Review Board for Human Research of the University Of Miami Miller School Of Medicine that was in agreement with the provisions of the Declaration of Helsinki. Hypotony maculopathy was defined as IOP ≤ 7 mm Hg on two consecutive post-operative visits associated with chorioretinal folds within the macular region.^{3–5} All patients underwent trabeculectomy using an intra-operative application of adjunctive mitomycin C (0.04%) for a duration of 1–3 minutes. Patients underwent complete ophthalmic examination including slit lamp

biomicroscopy, dilated stereoscopic examination, gonioscopy, Goldmann applanation tonometry, ultrasound pachymetry, and photography of the fundus and optic disc. Data was abstracted from the medical record including age, ethnicity, gender, lens status, visual acuity, refractive error, post-operative IOP, type of glaucoma, type of surgery performed, use of antifibrosis agent, and event leading to hypotony (i.e. suture lysis, bleb leak, overfiltration).

All patients underwent posterior segment imaging using TD-OCT (Stratus, software version 5.0.1; Carl Zeiss Meditec Inc, Dublin, California, USA), and three commercially available SD-OCT systems: Topcon 3D OCT (Model 1000, software version 2.12; Topcon, Tokyo, Japan); RTVue (Optovue Inc. software version A3.5.0.15, Fremont, California, USA); and Cirrus HD-OCT (Model 4000, software version 3.0; Carl Zeiss Meditec Inc, Dublin, California, USA). Exclusion criteria were consistent with the manufacturer's recommendations and consisted of images with a Signal Strength <6 (TD-OCT), Signal Strength Index <30 (RTVue), Quality Factor <45 (Topcon 3D OCT) and Signal Strength < 6 (Cirrus HD-OCT).

TD-OCT imaging was performed using a cross hair scan protocol. This scan protocol includes two B-scans intersecting on the fovea; horizontal and vertical 6 mm scans with 512 A scans per B scan. The location of the fovea was estimated by the instrument using a computer algorithm that searches for a local minimum in the total intraretinal reflectivity, which usually coincides with the relative absence of the plexiform layers in the foveal region. RTVue imaging was performed using the EMM5 (Enhanced Macular Map 5) and the 3D macula protocols. The EMM5 scan employs 11 horizontal lines with 5mm scan length, 6 horizontal lines with 3 mm scan length, 11 vertical lines with 5 mm scan length and 6 vertical lines with 3 mm scan length all at 0.5 mm interval and all centered at the fovea providing a total of 19,496 data points. The 3D macula scan captured 101 equally spaced B scans (each consisting of 512 A-scans) to cover a square area of 4 mm × 4 mm in 2.2 seconds providing a total of 51,712 data points. Topcon imaging was performed using the 3D macula protocol consisting of a raster-scan composed of 256 × 256 (vertical × horizontal) axial scans covering an area of 6 × 6 mm in the macular region. An automated overlay produces an en face OCT image of the scanned area on the fundus photograph. Cirrus imaging was performed using the Macular Cube protocol consisting of a 200 × 200 scan (200 horizontal B scans each consisting of 200 A-scans) which generated a cube of data through a 6 mm square grid and an automated overlay produces an en face OCT image of the scanned area on a fundus image. Macular chorioretinal folds were defined by OCT as retinal or subretinal undulation of OCT images within the macular region.

RESULTS

Seven eyes of 7 patients with hypotony maculopathy were enrolled in this study (Table 1). Mean age was 62.6 ± 8.2 years, mean spherical equivalent was -1.46 ± 1.94 diopters, and mean IOP was 3.6 ± 1.9 mm Hg. Table 2 compares the detection of hypotony maculopathy using horizontal and vertical TD-OCT images versus various SD-OCT instruments. In 6 of 7 cases, linear TD-OCT scans in the horizontal axis did not detect retinal or subretinal folds consistent with hypotony maculopathy. Two of 7 eyes had minimally detectable folds with TD-OCT imaging in the vertical axis. Five of 7 eyes did not show folds on TD-OCT in either axis. 3D topographic maps using SD-OCT demonstrated advanced retinal and subretinal folds throughout the macular region in all 7 patients. All eyes (4 cases) with no topographically detectable folds using SD-OCT within the foveal avascular zone had visual acuity of 20/25 or better. Three eyes with obvious contour disruption within the foveal pit had visual acuity ranging from 20/30 to 20/70 at the time of SD-OCT imaging. Representative cases are described below.

Case 1

A 55 year-old White female patient was referred for evaluation of decreased vision in the left eye three weeks following successful treatment of a bleb-related infection with topical antimicrobial therapy. Prior to her presentation she had undergone trabeculectomy with mitomycin C in 2000 and 2002 resulting in a visual acuity of 20/50 and IOP of 10 mm Hg. A non-purulent ischemic bleb was visualized which demonstrated brisk leakage overlying the scleral flap detected using Seidel testing. Visual acuity was 20/100 and the IOP was 3 mm Hg. Funduscopy examination revealed tortuous dilated retinal vessels and chorioretinal folds in the macular region (Figure 1 Top left). Radial TD-OCT imaging through the foveal region obtained along the horizontal axis (Figure 1 Top right) did not reveal evidence of chorioretinal folds; radial TD-OCT images obtained in the vertical axis confirmed the presence of macular folds (Figure 1 Bottom right). 3D surface topography mapping using SD-OCT imaging demonstrated the presence of marked retinal folds throughout the macular region visible with all three SD-OCT instruments (Figure 2). Moderate disruption of the contour of the foveal pit was observed.

The patient underwent bleb revision with anterior advancement of the conjunctival flap (Figure 3 Top left). One week post-operatively, the IOP had increased to 16 mm Hg and the vision had improved to 20/70 with persistent but improved macular folds visible on funduscopy examination. Five months post-operatively, the acuity improved to 20/30 with stable IOP of 14 mm Hg and resolution of macular folds and venous congestion.

Case 4

A 57 year-old Indian male with advanced primary open-angle glaucoma and an IOP of 13 mm Hg on maximal medical therapy underwent trabeculectomy with intraoperative mitomycin C (0.4 mg/ml) in the left eye. During the first post-operative week, one suture was lysed and the IOP was reduced to 2 mm Hg. No retinal folds were present in the macula, and the patient maintained 20/20 visual acuity throughout the follow-up period. Approximately three years post-operatively the patient complained of decreased vision and was found to have an early nuclear sclerotic cataract with a visual acuity of 20/20 and an IOP of 6 mm Hg. Funduscopy examination showed visible chorioretinal folds in the macular region (Figure 4 Top left) and TD-OCT imaging was performed. Radial TD-OCT scans obtained through the fovea along the horizontal axis (Figure 4 Top right) and vertical axis (Figure 4 Bottom right) demonstrated normal thickness and contour without evidence of retinal folds. 3D surface topography mapping using SD-OCT imaging demonstrated the presence of marked retinal folds throughout the macular region visible with all three SD-OCT instruments (Figure 5). No disruption of the foveal pit was observed. Observational monitoring without surgical revision was elected given the preservation of 20/20 visual acuity.

DISCUSSION

Hypotony maculopathy remains an important cause of vision loss following trabeculectomy with antifibrosis therapy. Gass² suggested that as the sclera falls inward in hypotony, folds are created by shrinkage and thickening of the sclera and engorgement of the overlying choroid, with visible wrinkling of the retinal pigment epithelium above it. Prompt identification and appropriate therapy is essential to restore vision and prevent permanent photoreceptor dysfunction. Clinical recognition of characteristic retinal vascular tortuosity and macular folds can be challenging in many eyes and often requires adjunctive diagnostic tests for confirmation. Fluorescein angiography² often reveals the characteristic alternating bands of hypo and hyper fluorescence consistent with hypotony-induced retinal folds but is an invasive procedure and has been marginalized considerably since the commercial

introduction of TD-OCT. Budenz et al.¹¹ reported three eyes with hypotony maculopathy in which radial TD-OCT imaging identified retinal and subretinal folds in the vertical or oblique axis.

We found that 3D topography maps reconstructed from SD-OCT imaging enhanced the detection of macular folds in eyes with ocular hypotony following glaucoma surgery. In 5 of 7 of our cases linear TD-OCT scans in the horizontal axis did not detect retinal or subretinal folds consistent with hypotony maculopathy; Two of 7 eyes had minimally detectable folds with TD-OCT imaging in the vertical axis. In contrast, 3D topographic maps using SD-OCT demonstrated retinal and subretinal folds throughout the macular region in all 7 patients. Several factors contribute to the increased sensitivity afforded by SD-OCT imaging. Macular folds associated with ocular hypotony tend to be oriented along the 0–180 degree axis.¹¹ Bullock and Egbert¹⁸ hypothesized that anterior retinal traction induced by the optic nerve in a hypotonous globe contributed to the tendency of macular folds to have a horizontal orientation. Some eyes with macular folds appear falsely normal using TD-OCT imaging, particularly when the orientation of radial imaging is aligned horizontally along the axis of the retinal folds.

By providing an en bloc image of the entire macular region, SD-OCT scans provide considerably increased sensitivity for detection of alterations in the surface topography of the retina. Other factors may contribute to the enhanced detection rate. In contrast to TD-OCT which collects 400 A-scans per second and has an axial resolution of 10 μm , SD-OCT is up to 60 times faster and can generate more than 25,000 A-scans per second with an axial resolution of 5 microns over a maximum scan area of 6 mm by 6 mm. In the present series, all three SD-OCT instruments were capable of generating high-resolution 3D topography images of the macular region and detection of macular folds with greater sensitivity as compared to linear scans obtained with TD-OCT. The Topcon system provides a digital fundus photograph with an enface surface thickness map overlay; the Topcon and Optovue systems display thickness maps against a fundus image.

Visual loss associated with hypotony may result from various pathogenic mechanisms, including corneal edema, induced astigmatism, cystoid macular edema, and hypotony maculopathy.^{8, 10} Cassidy and Sanders¹⁹ made a distinction between choroidal wrinkles, which are folds confined to the retinal pigment epithelium and Bruch's membrane, and coarse folds, which involve the full thickness of the choroid and are usually found in the macula and perimacular region. A similar distinction was made by Giufre and Distefano²⁰ who suggested that the two types of folds are part of a continuum and can appear concurrently in the same eye. Three of the patients in this report experienced moderate visual loss (20/30 – 20/70) and were found to have anatomic disruption of the central foveal pit as detected using SD-OCT. We speculate that irregular displacement of the photoreceptors within the foveal pit induces visual blur on the basis of distortion of the focal point. All 4 patients without mechanical disruption of the fovea centralis, an avascular region of the macula approximately 0.2 mm in diameter with a very high density of cones, retained 20/25 or better acuity. In the present series, anatomic preservation of the foveal pit was associated with visual preservation in eyes with ocular hypotony following glaucoma surgery. It is important to note that although subfoveal chorioretinal folds are associated with reduced visual acuity, the presence of chorioretinal folds elsewhere in the posterior pole is not necessarily an indication to pursue corrective intervention.

In summary, hypotony maculopathy is an important cause of visual loss following glaucoma filtration surgery. SD-OCT using 3D surface topography mapping provides greater sensitivity for hypotony maculopathy diagnosis and monitoring as compared with TD-OCT. These data highlight the important role of SD-OCT as an adjunct to clinical examination and

photography in patients with hypotony following glaucoma surgery. Disruption of the foveal pit as detected using SD-OCT is associated with reduced visual acuity.

Acknowledgments

Financial Support: This study was supported in part by NIH Grants R01-EY013516, R01-EY08684, Bethesda, Maryland; the Maltz Family Endowment for Glaucoma Research, Cleveland, Ohio; a grant from Mr. Barney Donnelley, Palm Beach, FL; The Kessel Foundation, Bergenfield, New Jersey; and an unrestricted grant from Research to Prevent Blindness, New York, New York.

The sponsor or funding organization had no role in the design or conduct of this research.

References

1. Dellaporta A. Fundus changes in postoperative hypotony. *American Journal of Ophthalmology* 1955;40:781–785. [PubMed: 13268576]
2. Gass, JDM. Contemporary Ophthalmology. In: Bellows, JG., editor. Honoring Sir Stewart Duke-Elder. Baltimore: Williams & Wilkins; 1972.
3. Fannin LA, Schiffman JC, Budenz DL. Risk factors for hypotony maculopathy. *Ophthalmology* 2003;110:1185–1191. [PubMed: 12799246]
4. Pederson, J. Ocular hypotony. Ritch, RSM.; Krupin, T., editors. Vol. 1. The Glaucomas; CV Mosby: 1996.
5. Costa VP, Arcieri ES. Hypotony maculopathy. *Acta Ophthalmol Scand* 2007;85:586–597. [PubMed: 17542978]
6. Schubert HD. Postsurgical hypotony: Relationship to fistulization, inflammation, chorioretinal lesions, and the vitreous. *Survey of Ophthalmology* 1996;41:97–125. [PubMed: 8890437]
7. Bindlish R, Condon GP, Schlosser JD, et al. Efficacy and safety of mitomycin-C in primary trabeculectomy: Five-year follow-up. *Ophthalmology* 2002;109:1336–1341. [PubMed: 12093659]
8. Wellik SR, Schiffman JC, Budenz DL, Greenfield DS. Relationship between central corneal thickness and hypotony-related complications after glaucoma surgery. *Ophthalmic Surgery Lasers and Imaging* 2008;39:281–287.
9. Suner IJ, Greenfield DS, Miller MP, et al. Hypotony maculopathy after filtering surgery with mitomycin C: Incidence and treatment. *Ophthalmology* 1997;104:207–215. [PubMed: 9052624]
10. Liebmann JM, Sokol J, Ritch R. Management of chronic hypotony after glaucoma filtration surgery. *J Glaucoma* 1996;5:210–220. [PubMed: 8795762]
11. Budenz DL, Schwartz K, Gedde SJ. Occult Hypotony Maculopathy Diagnosed With Optical Coherence Tomography. *Arch Ophthalmol* 2005;123:113–114. [PubMed: 15642824]
12. Kokame GT, de Leon MDL, Tanji T. Serous retinal detachment and cystoid macular edema in hypotony maculopathy. *American Journal of Ophthalmology* 2001;131:384–386. [PubMed: 11239878]
13. Martinez de la Casa JM, Garcia Feijoo J, Castillo Gomez A, et al. Hypotony maculopathy diagnosed by optical coherence tomography. *Arch Soc Esp Oftalmol* 2003;78:567–569. [PubMed: 14569506]
14. Srinivasan VJ, Ko TH, Wojtkowski M, et al. Noninvasive Volumetric Imaging and Morphometry of the Rodent Retina with High-Speed, Ultrahigh-Resolution Optical Coherence Tomography. *Invest Ophthalmol Vis Sci* 2006;47:5522–5528. [PubMed: 17122144]
15. van Velthoven MEJ, Faber DJ, Verbraak FD, et al. Recent developments in optical coherence tomography for imaging the retina. *Progress in Retinal and Eye Research* 2007;26:57–77. [PubMed: 17158086]
16. Podoleanu AG, Rosen RB. Combinations of techniques in imaging the retina with high resolution. *Progress in Retinal and Eye Research* 2008;27:464–499. [PubMed: 18495519]
17. Pagliara MM, Lepore D, Balestrazzi E. The role of OCT in glaucoma management. *Prog Brain Res* 2008;173:139–148. [PubMed: 18929106]

18. Bullock JD, Egbert PR. The origin of choroidal folds a clinical, histopathological, and experimental study. *Documenta Ophthalmologica* 1974;37:261–293.
19. Cassidy LM, Sanders MD. Choroidal folds and papilloedema. *Br J Ophthalmol* 1999;83:1139–1143. [PubMed: 10502574]
20. Giuffre G, Distefano MG. Optical coherence tomography of chorioretinal and choroidal folds. *Acta Ophthalmol Scand* 2007;85:333–336. [PubMed: 17488465]

Figure 1. Fundus photograph (Left) of the patient described in Case 1 demonstrating marked vascular tortuosity and retinal folds throughout the posterior pole. Time domain optical coherence tomography (TD-OCT) scans of the same patient in the horizontal (Top right) and vertical meridian (Bottom right) demonstrate absence of folds in the horizontal axis but retinal and subretinal folds visible in the vertical axis.

Figure 2.

Spectral domain optical coherence tomography (SD-OCT) images corresponding to the patient described in Case 1 demonstrates macular folds using all three SD-OCT instruments. (Top left) Fundus photograph with en face surface thickness map overlay generated from the Topcon SD-OCT data. (Bottom left): Three-dimensional surface thickness map reconstructed from the Topcon 3D Macular Scan representing a 6 mm × 6 mm macular area. (Middle top): Optovue SD-OCT Enhanced Macular Map 5 scan demonstrates retinal pigment epithelium elevation map on a superimposed fundus image with color-coded significance values compared to a normalized reference plane. (Middle bottom): Optovue retinal surface map obtained from the 3D macula scan representing a 4 mm × 4 mm macular area. (Top right): Cirrus SD-OCT Overlay Map (Internal Limiting Membrane – Retinal Pigment Epithelium) demonstrates the retinal thickness map superimposed on a fundus image. (Bottom right): Cirrus SD-OCT three dimensional surface map displaying the macular topography (Internal Limiting Membrane – Retinal Pigment Epithelium) in a 6 mm × 6 mm macular area.

Figure 3.

Anterior segment photograph (Top left) of the patient described in Case 1 illustrates bleb appearance on the first post-operative day following bleb revision and conjunctival advancement. Fundus photograph (Top right) five months following bleb-revision demonstrates resolution of macular folds and vascular congestion. Resolution of macular folds and restoration of the foveal pit are visualized on the three-dimensional surface thickness map reconstructed from the Topcon 3D Macular Scan (Bottom left), Optovue 3D Macular Scan retinal surface map (Bottom middle), and Cirrus SD-OCT three dimensional surface map (Bottom right).

Figure 4. Fundus photograph (Left) of the patient described in Case 4 demonstrating horizontally oriented retinal folds in the macular region. Time domain optical coherence tomography (TD-OCT) scans of the same patient in the horizontal (Top right) and vertical meridia (Bottom right) demonstrate absence of folds.

Figure 5.

Spectral domain optical coherence tomography (SD-OCT) images corresponding to the patient described in Case 4 demonstrates macular folds using all three SD-OCT instruments. (Top left): Fundus photograph with en face surface thickness map overlay generated from the Topcon SD-OCT data. (Bottom left): Three-dimensional surface thickness map reconstructed from the Topcon 3D Macular Scan representing a 6 mm $\times$ 6 mm macular area. (Top middle): Optovue SD-OCT Enhanced Macular Map 5 scan demonstrates retinal pigment epithelium elevation map on a superimposed fundus image with color-coded significance values compared to a normalized reference plane. (Bottom middle): Optovue retinal surface map obtained from the 3D macula scan representing a 4 mm $\times$ 4 mm macular area. (Top right): Cirrus SD-OCT Overlay Map (Internal Limiting Membrane – Retinal Pigment Epithelium) demonstrates the retinal thickness map superimposed on a fundus image. (Bottom right): Cirrus SD-OCT three dimensional surface map displaying the macular topography (Internal Limiting Membrane – Retinal Pigment Epithelium) in a 6 mm $\times$ 6 mm macular area.

Table 1

Clinical characteristics of the study population (n=7)

	Age (yrs)	Gender	Ethnicity	Glaucoma	Lens Status	Spherical Equivalent (D)	IOP (mm Hg)	Event Precipitating Hypotony
Case 1	55	F	White	POAG	Phakic	-2.75	3	Bleb Leak
Case 2	54	M	White	NTG	Pseudo	-1.0	3	Overfiltration
Case 3	68	F	White	NTG	Phakic	+1.75	4	Suture Lysis
Case 4	57	M	Indian	POAG	Phakic	-2.5	6	Overfiltration
Case 5	74	F	White	NTG	Pseudo	-3.0	2	Overfiltration
Case 6	71	F	White	PG	Pseudo	-3.25	6	Choroidal Effusion
Case 7	59	M	White	PG	Phakic	+5	1	

POAG = primary open-angle glaucoma; NTG = normal-tension glaucoma; PG = pigmentary glaucoma; M = male; F = female; Pseudo = pseudophakia; IOP = intraocular pressure.

Table 2

Detection of macular folds using time domain (TD-OCT) versus spectral domain optical coherence tomography (SD-OCT).

	BCVA	Macular folds TD-OCT		Macular Folds SD-OCT			FAZ Folds
		Horizontal	Vertical	Cirrus	RTVue	Topcon	
Case 1	20/70	-	+	+	+	+	+
Case 2	20/30	+	+	+	+	+	+
Case 3	20/25	-	-	+	+	+	-
Case 4	20/20	-	-	+	+	+	-
Case 5	20/20	-	-	+	+	+	-
Case 6	20/20	-	-	+	+	+	-
Case 7	20/60	-	-	+	+	+	+

BCVA = best corrected visual acuity; FAZ = foveal avascular zone; TD-OCT = time domain optical coherence tomography; SD-OCT = spectral domain optical coherence tomography