Spectral domain OCT to diagnose clinically inapparent hypotony maculopathy using 3D image rendering software

Muhammad Raja, Stavoroula Boukavala, Craig Goldsmith, Subhanjan Mukherji

Department of Ophthalmology,
James Paget University
Hospital NHS Foundation Trust,
Great Yarmouth, Norfolk, UK

Correspondence to
Muhammad Raja,
docraja@hotmail.com

SUMMARY

Three-dimensional (3D) image rendering capability of a commercially available 3D-optical coherence tomogram (OCT) system was used to diagnose a subclinical but symptomatic case of hypotony maculopathy in an eye with significant cataract and an only-eyed patient. Bleb revision improved intraocular pressure and symptoms, confirmed by repeat OCT imaging. Hypotony maculopathy may be subclinical and difficult to diagnose particularly in eyes with non-clear ocular media. Use of spectral domain OCT can be complementary to improve patient outcomes.

BACKGROUND

Spectral domain optical coherence tomogram (SD-OCT) is an exciting new tool to monitor not only retinal but also glaucoma-related pathology.¹ Three-dimensional (3D) software image rendering can complement clinical decision-making but the full capability of the various scan options and image rendering software provided by commercial SD-OCT machines is not fully explored yet. There are many OCT machine brands available that offer multiple options in terms of scanning parameters, image rendering such as 2D standard B scan, 3D volume cube and en-face images with varying image resolution. Clinicians are commonly used to interpret standard B-scans of the SD-OCT but as presented in our case, simultaneous use and appreciation of 3D image rendering pictures and videos can aid the diagnosis and management of sight threatening postoperative problems like hypotony maculopathy.

We report the use of commercially available SD-OCT 2D and 3D imaging rendering to diagnose and plan treatment in a case of clinically inapparent hypotony maculopathy with visual symptoms.

CASE PRESENTATION

Single case report of an only-eyed patient with progressive optic disc cupping, despite treatment on maximal medical therapy and no obvious drug compliance issues.

At baseline the patient had moderate nuclear sclerotic cataract with a 0.9 cupped disc and a visual acuity of 0.3 LOGMAR (Snellens 6/12). Augmented trabeculectomy with mitomycin-C was carried out. Postoperative intraocular pressures were noted to be 8, 6 and 6 mm Hg at day 1, weeks 1 and 2 follow-up with a good filtering bleb. Persistent central blur was noted by the patient and clinical examination showed deep anterior chamber (AC) but no clinical macular striae or folds and

fundus examination was hindered by significant cataract precluding good macular view. Other causes of hypotony as bleb leak were excluded. The visual acuity was LOGMAR 0.4 (Snellens 6/15) and the patient was concerned as reading was now problematic in an only eye.

Because of significant cataract, clinical examination failed to show any apparent cause for the blurry vision. Single foveal B scans (Topcon 3-d 1000 OCT) failed to convincingly show the retinal pigment epithelium (RPE) irregularity (figure 1A).

Following acquisition of macular 6×6 mm raster scan, 3D rendering including image cropping with peeling of segmented tissue layers and videos of macular cube images clearly showed the RPE irregularity affecting the macular region confirming subclinical hypotony maculopathy with RPE folds (figure 1B). The software used is native to the commercially available and installed software that comes prepackaged with the OCT system (Topcon 3-D 1000, Topcon Inc, Japan). Figures 2 and 3 along with videos 1 and 2 clearly show the prebleb and postbleb manipulation RPE regularity change.

INVESTIGATIONS

Use of native, commercially in-built 3D image rendering software for 3D 1000 Topcon OCT machine to better delineate the retinal and retinal pigment epithelium morphology.

DIFFERENTIAL DIAGNOSIS

Hypotony post-trabeculectomy is either an excessive drainage issue such as wound/bleb leak (as in our case) or inflammatory shutdown of the ciliary body that turns off the tap for aqueous humour production.

TREATMENT

Bleb revision was carried out that improved intraocular pressure and was clearly visualised by OCT scans but not clinically.

OUTCOME AND FOLLOW-UP

Trabeculectomy bleb was revised and intraocular pressure (IOP) adjusted to 11 mm Hg at 3 months follow-up. This was clearly appreciated (figure 4A,B) on the 3D rendered macular volume cube scans confirmed by RPE regularity on OCT and symptomatic resolution. The visual acuity improved to pre-operation level of LOGMAR 0.3 (Snellens 6/12) and usual reading ability. The patient was not keen to undergo cataract surgery.

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Figure 1 (A) Top left, colour fundus photograph with poor macular details because of cataract; bottom left, single B-scan fails to show retinal pigment epithelium (RPE) irregularity. (B) Top and bottom right show three-dimensional rendered, cropped and segmented images clearly showing the RPE folds (arrows).

DISCUSSION

SD-OCT is complementary and possibly diagnostic in cases with symptomatic but subclinical hypotony maculopathy as clearly shown by our case. With significant cataract causing non-optimal ocular media for fundal examination, SD-OCT provided us an opportunity to utilise the imaging software capability especially 3D macular cube volume images to diagnose, intervene and monitor hypotony maculopathy, which otherwise was not feasible. It was interesting to note that the full extent of RPE irregularity was clearly demonstrated on reviewing the 3D macular cube in our patient and a single b-scan foveal cut was not very informative (figures 1 and 4).

Interest in the use of OCT has gathered pace over the last few years,^{2–5} but the arrival of SD-OCT has added an exciting new tool for glaucoma specialists. Lima *et al*⁵ in their excellent paper, have published the largest series of hypotony maculopathy diagnosis using Topcon 3-D 1000 OCT. Our case extends the use of Topcon 3-D 1000 further, being used preoperatively and postoperatively in an eye with hazy ocular media to diagnose, treat and monitor hypotony maculopathy successfully. Clinicians need to be aware of the various scanning options, as well as image rendering software capabilities of the spectral domain OCT machines they are using, to maximise positive outcomes for the patients.

Figure 2 (A) Top left, B-scan shows retinal pigment epithelium (RPE) with no folds. (B) Top and bottom left; three-dimensional rendered image confirms the smooth and regular appearance of the RPE compared with (B) (arrows).

Figure 3 Hypotony maculopathy clearly visualised by a series of six three-dimensional cropped, rotated and segmented images showing irregular and bumpy retinal pigment epithelium (blue arrows, Topcon 3-D 1000 images).

Video 1 Baseline three-dimensional video showing retinal pigment epithelium folds.

Video 2 Post-Bleb revision. Smooth and regular RPE contour.

Figure 4 Following bleb revision. Series of six three-dimensional cropped, rotated and segmented images clearly show smooth and non-bumpy retinal pigment epithelium at 4-month follow-up (blue arrows, Topcon 3-D 1000).

Learning points

- ▶ Hypotony maculopathy may be subclinical and not necessarily obvious.
- ▶ Effective use of newer technology like spectral domain optical coherence tomogram (SD-OCT) may improve a clinician's diagnostic ability in difficult cases.
- ▶ Applicability of newer technology needs the appreciation of varying software image-enhancing tools like three-dimensional image rendering in commercially available OCT systems.

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Patient consent Obtained.

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