Usefulness of anterior chamber optical coherence tomography in glaucoma

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Abstract

The aim of the study is to describe and assess whether anterior chamber optical coherence tomography (OCT) has the capacity to produce high quality images of patients with different angle configurations and to follow bleb's morphology after glaucoma surgery. The eyes of two patients were evaluated with Visante OCT (Carl Zeiss Meditec, Inc., Dublin, CA, USA) in emergency pupillary block and in follow-up after non-penetrating deep sclerectomy. Visante OCT provided high-resolution information regarding iris configuration and was useful to explore bleb's morphology in patients after glaucoma surgery. Visante OCT offers a quick non-contact method of assessing the configuration of the anterior chamber angle. Despite its limitations, it may be of help during routine clinical evaluation of patients with glaucoma.

Introduction

Assessment of the anterior chamber angle (ACA) is a critical part of the diagnosis, management, and follow-up of glaucoma patients. Gonioscopy is an important clinical tool for clinically evaluating the anatomy of the anterior chamber angle.[1,2] However, this subjective technique requires clinical expertise for accurate interpretation and involves direct contact with the subject's eye.[3] Ultrasound biomicroscopy (UBM) is a more objective and reliable method but also requires contact.[4,5] In contrast, optical coherence tomography (OCT) allows high-resolution, cross-sectional imaging of the eye. Besides, it is non-invasive, quick, and easy to use.[4,6] For all these reasons, it can be a good choice for evaluating angle configuration, including changes induced by laser iridotomy or after glaucoma surgery.

Case Reports

Case #1: acute angle-closure without pupillary block (Plateau iris configuration)

A 41-year-old female patient arrived at the emergency unit with painful red eyes and blurry vision. She had no previous ocular or systemic history but a few hours earlier she had been given tropicamide in a routine ophthalmological examination. Intraocular pressure (IOP) was 40 mmHg in the right eye and 50 mmHg in the left eye. The slit-lamp examination revealed conjunctival injection and microcystic corneal edema. Gonioscopy showed closure chamber angle (grade 0, Schaffer Grading System). She didn't t have a previous laser iridotomy. Imaging of the anterior chamber by OCT showed that the iris root was angulated and iris configuration was compatible with a plateau iris configuration (Figure 1). The patient was treated with acetazolamide, pilocarpine 1%, timolol 0.5% and argon laser peripheral iridoplasty. Two hours after, intraocular pressure was 20 mmHg in both eyes. Post-treatment gonioscopy with iridoplasty argon laser revealed a degree I angle in the superior, nasal, and temporal quadrants and degree II in the inferior.

Case #2: non penetrating deep sclerectomy follow-up

A 67-year-old male patient arrived at the glaucoma unit with a long history of glaucoma, then being treated with latanoprost, brinzolamide, and brimonidine in both eyes. He had previous ocular history of right eye satisfactory retinal detachment surgery and chronic obstructive pulmonary disease. Consequently, beta-blockers were contraindicated in his treatment. IOP was 24 mmHg in the right eye and 19 mmHg in the left eye. Funduscopy revealed optic disc cupping of 0.9 in the right eye and 0.5 in the left eye. Repeated visual fields demonstrated remarkable progression in right eye so glaucoma surgery was indicated. Uneventful non penetrating deep sclerectomy follow-up (NPDS) was performed and IOP was lower than 15 mmHg in all follow-up visits. In Figure 2, the morphological characteristics of the bleb seen by Visante OCT.

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Discussion

Until recently, evaluation of the ACA has been limited to subjective techniques, mainly gonioscopy.[5] It consists of visualizing the camerular angle through a contact exploration lens. The most common are 3 mirror Goldman or 4 mirror Ziess and Sussman. This method requires direct contact with the patient's ocular surface and therefore depends on patient's cooperation as well as the examiner's skill and experience.[6,7] Another alternative is UBM, which is based on the production of ultrasounds, which go through the various ocular tissues and undergo reflection and dispersion phenomena that generate waves (echoes) that return to the transductor and result in images. However, it requires positioning a scanning

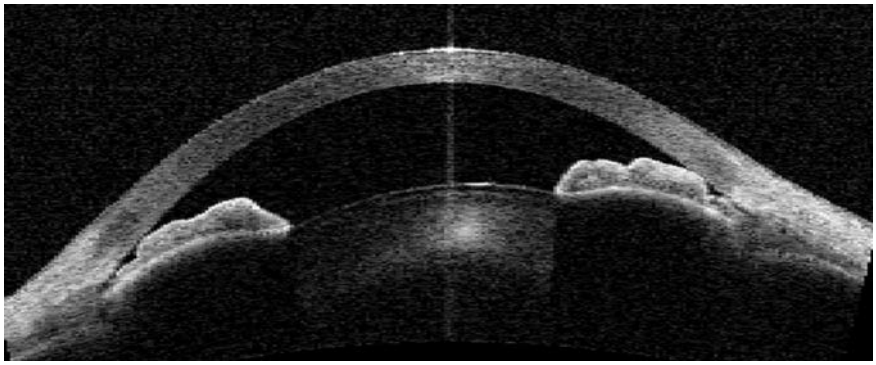

Figure 1. Visante anterior segment optical coherence tomography image showing plateau iris configuration. Image show a prominent last roll that blocks the view of the angle with an anterior chamber relatively deep in the central part.

probe near the globe and controlling eye accommodation is difficult.[5,8,9] On the other hand, anterior segment Visante OCT was designed based on its low coherence interferometry, with a superluminescent diode with a wavelength of 1310 nm and minimizes the influence of accommodation by adjusting the focus of the internal fixation target in reference to the subject's refractive error at distance.[2,10]

The major advantages of this technique include speed of image acquisition and high resolution, as well as ease of operation.[5,11,12] Furthermore, the non-contact method eliminates inadvertent compression of the globe, which is especially useful in the immediate follow-up after glaucoma surgery.

In patients with plateau iris configuration, OCT images could permit the detection of different iris configurations by non-glaucoma specialists or optometrists.[13-15] The main limitation or disadvantage of OCT Visante exploration is that it does not allow for ease of identification or observation of the ciliary body and consists of equipment that is more expensive than UBM. Furthermore, this technique may render images that with gonioscopy appear as open and with the former appear closed. It also requires an examiner with a degree of experience to take good images and avoid observer variability.[2,16] A successful NPDS surgery depends on the formation of a filtering bleb and its morphology, because it is an indicator of function and predicts bleb-related complications.[9] UBM have been used to characterize the typology of blebs[9,17] and the introduction of quick and non-contact methods like Visante OCT may be a good alternative to follow-up the bleb formation in the immediate post-operative period of glaucoma patients. Visualising internal bleb morphology would improve the understanding of the wound healing process after glaucoma surgery.

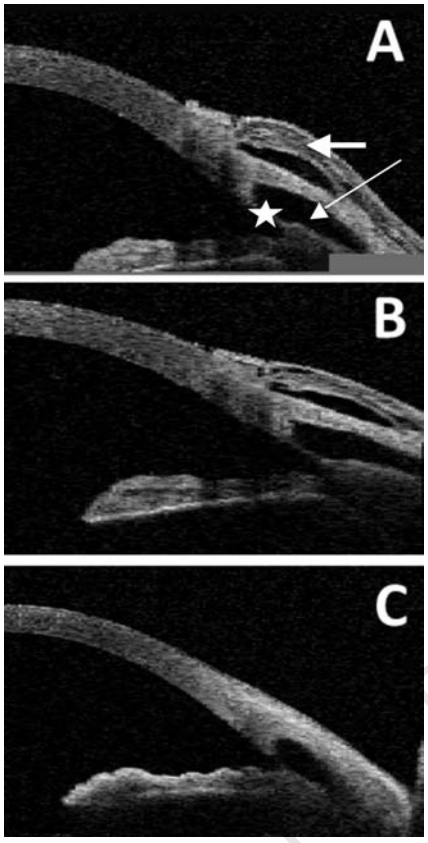

Figure 2. Serial intrableb morphologies of case 2, after uncomplicated non penetrating deep sclerectomy follow-up. A) 24 h after surgery, a filtration of the aqueous humor is observed towards the intrascleral lake (thin arrow) and the conjunctival bleb (thick arrow). B) corresponds to the first postoperative month, when a remodeling of the conjunctival bleb with the formation of aqueous humor spaces in the bleb is observed. C)ninth postoperative month, the conjunctival bleb becomes shallow and there is a reduction of the intrascleral lake. The white star corresponds to the trabecular meshwork.

Conclusions

Visante OCT is a quick and non-invasive imaging technique that allows the detection of different anterior chamber angle configurations and the analysis of bleb's morphology after glaucoma surgery.

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