

Imaging of filtering blebs after implantation of the Ex-PRESS shunt with the use of the Visante optical coherence tomography

*Aristeidis Konstantinidis*¹, *Georgios D Panos*^{1,2}, *Magdalini Triantafylla*¹, *Georgios Labiris*¹, *Efthimia Tsaragli*¹, *Zisis Gatzoufas*², *Vassilios Kozobolis*¹

¹Department of Ophthalmology, University Hospital of Alexandroupolis & Eye Institute of Thrace, Dragana 68100, Alexandroupolis, Greece

²Department of Ophthalmology, Geneva University Hospitals, Faculty of Medicine, University of Geneva, CH 1211, Geneva 14, Switzerland

Correspondence to: Georgios D Panos. Department of Ophthalmology, Geneva University Hospitals, Rue Alcide-Jentzer 22, CH 1211, Geneva, Switzerland. gdpanos@gmail.com; Georgios.Panos@hcuge.ch

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Abstract

• **AIM:** To analyze the features of the filtering blebs following implantation of the Ex-PRESS glaucoma device (model P-50) with the aid of the Visante anterior segment optical coherence tomography (AS-OCT)

• **METHODS:** Five patients with open angle glaucomas were included in the study. They all underwent implantation of the Ex-PRESS device under a scleral flap. The surgical procedure was augmented with the use of mitomycin C subconjunctivally. The filtering blebs were analyzed with the Visante AS-OCT with the scans taken along the axis of the implantation of the glaucoma device.

• **RESULTS:** All filtering blebs were graded as diffuse functioning. The morphological characteristics of the blebs were similar to those of the trabeculectomy. However the use of the Ex-PRESS implant tend to form a characteristic episcleral lake at the site of the plate of the implant.

• **CONCLUSION:** The use of the Ex-PRESS implant produces filtering blebs similar to those of the trabeculectomy with the formation of a characteristic episcleral lake at the site of the plate of the implant.

• **KEYWORDS:** Ex-PRESS; glaucoma; optical coherence tomography

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INTRODUCTION

Trabeculectomy (TE) has been the standard surgical approach since its first description by Cairns^[1,2]. Although it is a successful operation in terms of intraocular pressure (IOP) control it has been associated with a considerable number of early and late complications and this has given rise to the development of newer techniques with less complications^[3-5].

The Ex-PRESS glaucoma implant has shown equal effectiveness as the standard TE with fewer side effects^[6,7]. The aim of this study is to describe the position of the antiglaucoma device in relation to the surrounding tissues and show the characteristics of the aqueous flow through the device and its collection under the conjunctiva.

SUBJECTS AND METHODS

Five patients with medically uncontrolled open angle glaucoma were included in this study. They were all treated with the insertion of the Ex-PRESS mini shunt model P50 under a 4×4-mm² scleral flap. Mitomycin C 0.2 mg/mL for 2min was applied under the conjunctiva before the formation of the scleral flap. The surgical procedure was augmented with the injection of 0.1 mL of triamcinolone just behind the site of the scleral flap with the use of a bent 27 G needle at the end of the operation. All patients were phakic at the time of the shunt insertion.

Serial anterior segment optical coherence tomography (AS-OCT) scans were taken in all patients 2wk, 1mo and then every 4mo postoperatively. Patients 1 and 5 had scans at 2wk, 1mo and every 4mo for the first postoperative year and every 6mo thereafter. The scans were taken with the patient looking into the instrument as well as looking down in order to include in the scan the largest possible area of the filtering bleb. We tried to include the Ex-PRESS mini shunt in all scans so as to investigate the aqueous filtration through the shunt and under the scleral flap and conjunctiva. In order to capture the drainage device in the pictures, the scans were taken along the axis of the insertion of the device. The scans taken at the last follow up are shown in this study.

Table 1 Demographics and clinical information of patients

Parameters	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Age/gender	75/M	51/M	72/F	78/M	59/F
Preop/postop at last follow up					
BCVA logMAR	0/0.15	0.4 / 1.0	0.5/0.5	0.4/0.4	0.2/0.2
IOP (mm Hg)	32/18	38/23	29/13	35/12	34/17
Antiglaucoma medication	3/0	3/0	3/0	3/0	3/0
Follow up period (mo)	26	9	5	5	36
Type of glaucoma	PXG	PXG	PXG	POAG	PXG
Previous operations	None	TE × 1, TR × 1	None	None	None
Further interventions	None	5FU × 2	None	None	None

PXG: Pseudoexfoliation glaucoma; POAG: Primary open angle glaucoma; 5FU: Subconjunctival injection of 5-fluorouracil; TE: Trabeculectomy; TR: Trabeculectomy revision.

The demographics as well as the preoperative and postoperative clinical information are summarized in Table 1. Written consent was obtained from all 5 patients. The study adhered to the tenets of the Declaration of Helsinki. The study protocol was approved by the Ethical Committee of the Eye Institute of Thrace.

RESULTS

Patient 1 This 75 year-old man had an Ex-PRESS device insertion in his left eye for pseudoexfoliation glaucoma (PXG). The AS-OCT scans taken 26mo later show that the device is well positioned in front of and parallel to the plane of the iris with a streak-like subconjunctival collection of aqueous humor representing the flow under the conjunctiva (Figure 1A).

Patient 2 A 51 year-old man with a history of PXG presented with medically uncontrolled IOP in the right eye. We created a new scleral flap just next to site of the original flap. The patient had undergone an initial TE 2y before the insertion of the Ex-PRESS mini-shunt which failed and therefore he had a TR which also failed. The IOP at the last follow up 9mo post the Ex-PRESS insertion was 15 mm Hg with signs of ample aqueous flow in the subconjunctival/subtenon's space. The AS-OCT scans shows an episcleral fluid collection under the scleral flap with diffuse subconjunctival aqueous pooling and the presence of microcysts in the bleb wall (Figure 1B).

Patient 3 A 72 year-old woman was managed with the use of an Ex-PRESS device for PXG. The AS-OCT scans five months later show that the antiglaucoma shunt indents the iris without causing any clinical complications. There is also accumulation of aqueous under the scleral flap with subconjunctival aqueous flow and microcysts in the bleb wall (Figure 2). As the patient is symptom free and the IOP is well controlled a decision not to reposition the shunt was taken.

Patient 4 This 78 year-old man underwent Ex-PRESS shunt implantation for primary open angle glaucoma in his left eye. The patient has had bilateral peripheral YAG laser

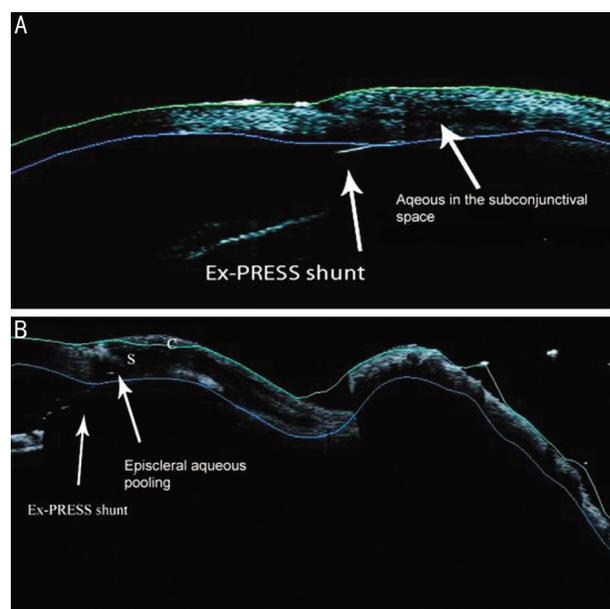


Figure 1 Well positioned express device A: A well positioned Ex-PRESS device with subconjunctival aqueous flow; B: A well positioned Ex-PRESS device with episcleral pooling, subconjunctival flow (s) and conjunctival epithelial cysts (c).

iridectomies which were done at another hospital. Gonioscopy before surgery revealed open angles bilaterally with convex iris insertion to the ciliary body due to cataracts. A decision to proceed with Ex-PRESS shunt implantation was taken as the patient declined a combined procedure with cataract extraction. The AS-OCT scans 5mo after surgery show that the tip of the device lies in the posterior chamber through a patent YAG iridectomy. There are also signs of episcleral aqueous collection, subconjunctival aqueous flow and bleb wall thickening (Figure 3A). As the IOP is well controlled we decided not to reposition the device.

Patients 5 A 59 year-old woman had a history of medically uncontrolled pseudoexfoliation glaucoma was managed with the insertion of an Ex-PRESS antiglaucoma device. The AS-OCT scans 3y later show a well positioned shunt with subconjunctival aqueous filtration and bleb wall thickening (Figure 3B).

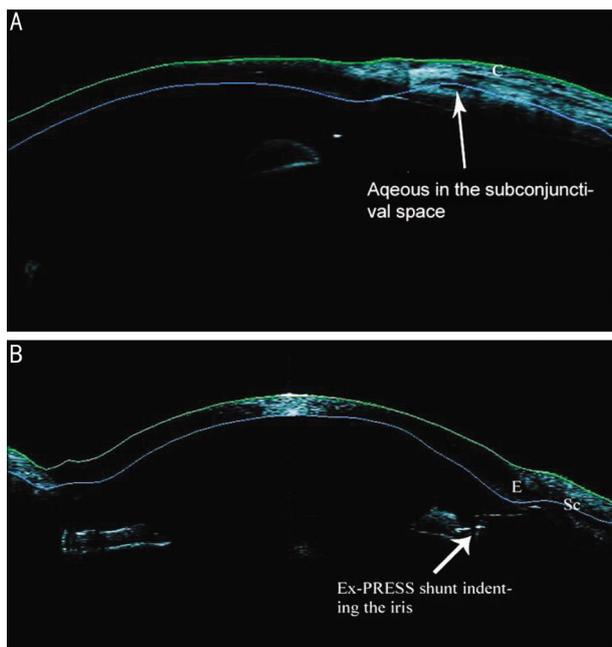


Figure 2 Accumulation of aqueous under the scleral flap A: Aqueous flow in the subconjunctival space with formation of conjunctival epithelial microcysts (c); B: Iris indentation by the Ex-PRESS device with aqueous pooling in the episcleral (E) and subconjunctival space (Sc).

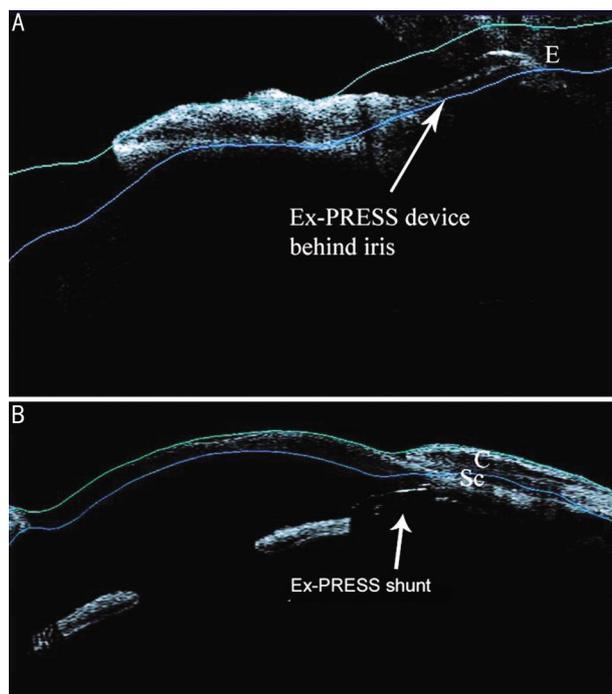


Figure 3 Subconjunctival aqueous filtration and bleb wall thickening A: Ex-PRESS device behind the iris with episcleral pooling (E); B: A well positioned Ex-PRESS implant with subconjunctival aqueous flow (Sc) and diffuse conjunctival thickening (c).

DISCUSSION

The use of optical coherence tomography (OCT) in the investigation of the function of the filtering blebs following TE has been explored in previous studies [8-12]. The aim of

these studies was to identify the morphological features of the blebs as shown in the OCT scans that are correlated with good bleb function and IOP control. Generally these features include a subconjunctival aqueous filled cavity, the presence of microcysts in the bleb wall and a hyper-reflective thick wall[8]. AS-OCT analysis of the filtering blebs offers the great advantage over ultrasound biomicroscopy (UBM) of not requiring contact with the eye and thus reducing patient discomfort, risk of infection and bleb distortion.

To the best of our knowledge this is the first attempt to visualize the Ex-PRESS mini implant with AS-OCT and evaluate the bleb features in open angle glaucomas. Verbraak *et al* [13] analyzed the position of the Ex-PRESS shunt in relation to the surrounding anterior segment structures with the use of a 1280 nm OCT. The study was done on *ex-vivo* porcine eyes with the shunt implanted after enucleation directly under the conjunctiva. Apparently there was no flow of aqueous humor.

In this study we tried to show the relation of the Ex-PRESS shunt with the surrounding structures and the morphology of the filtering blebs. The scans were taken along the shunt in order to visualize the flow of the aqueous through the shunt. In some scans we identified the formation of aqueous pooling between the scleral flap and the flange of the Ex-PRESS device (patients 2, 3, 4). We also demonstrated that the AS-OCT can accurately show the position of the device in cases of malpositioned shunts (patients 3, 4).

The morphology of the bleb in all of the patients was consistent with good bleb function as described in previous studies [8-12] as it showed the presence of subconjunctival aqueous flow and thick bleb walls with microcysts. We did not attempt to quantify the results of the study by measuring the various features of the bleb because the small cohort of patients would make a meaningful statistical analysis impossible.

In conclusion the imaging the Ex-PRESS mini implant with the Visante AS-OCT is challenging due to its small size. However it can very accurately show the anatomic relation of the device with the adjacent tissues as well as the function of the filtering bleb.

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