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Microscope-integrated intraoperative OCT in ophthalmological examination of pediatric patients under anesthesia: 3 cases

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Abstract

Introduction: The examination of certain patients in consultation, due to their young age, lack of collaboration or associated pathologies can be very complicated or insufficient. In cases of suspected diagnosis, an examination under sedation in the operating room is necessary. Classic tests such as sciascopy, renography, biometry or keratometry are very useful, however, microscope integrated intraoperative optical coherence tomography allows examining structures that are easily evaluable in clinical routine but not in this type of examination with sedation.

Case report: We report three cases of pediatric patients, examined under sedation. In these cases, intraoperative Optical Coherence Tomography (OCT) has been essential to reach the diagnosis.

Conclusion: Intraoperative OCT is very useful as part of the pediatric examination under sedation. It allows the evaluation of structures and issues that could not be explored under their appearance and therefore, it helps to diagnose more precisely.

Keywords: Pediatric patients; Intraoperative optical coherence tomography; Foveal aplasia; Cornea; Congenital glaucoma.

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Introduction

The examination of pediatric patients frequently presents limitations. We will probably find it more difficult to obtain information at a younger age of the patient. In addition, we must keep in mind the context of the patient (if he has a delay in maturation or any associated pathology that may make the examination more difficult). Because of this, sometimes we do not achieve a precise diagnosis or a complete examination in the consultation, and on certain occasions, we require an examination under sedation in the operating room.

When we perform an ophthalmological evaluation under general anesthesia in a pediatric patient, we usually perform sciascopy under cycloplegia, anterior segment examination with a microscope or portable slit lamp, eye fundus examination (being able to collect images if a portable retino graph is available), tonometry, ultrasound, biometry with axial length measurements and keratometry in cases, for example, of congenital cataracts in which surgery is to be considered.

However, there are structures that we have not been able to accurately evaluate on a regular basis due to not being able to perform some complementary tests, which in consultation and with collaborating patients is something routine, but not in the pediatric age group [1]. Specifically, we are referring to optical coherence tomography, it is a non-contact and non-invasive diagnostic imaging method that allows to obtain images of ocular

issues in cross sections with very high-quality micrometric resolution [2], which provides additional information: In alterations of the anterior segment that due to the existence of corneal opacity, we cannot visualize directly, as in structures of the posterior segment [3].

In recent months, we have introduced, in cases that have required it, the use of a surgical Microscope with Integrated OCT (MI-OCT) to complete the examination, obtaining very useful information to be able to establish a more precise diagnosis in patients and, therefore, to be able to better define the therapeutic approach to follow, thus improving the visual prognosis of these children [4]. In the work that we present here, we used a group of patients to illustrate the advantages of this technique and describe a new range of indications in both anterior and posterior segments.

Case description

We present three pa ents who were examined at Hospital Arruzafa (Córdoba, Spain) by examination under general anesthesia, using a microscope with integrated intraoperative OCT (Zeiss Opmi Lumera 700). We have assessed whether the additional information obtained from this test had a significant impact on the therapeutic decision-making process.

Zeiss Opmi Lumera 700 is a combination of opera ng microscope, OCT, surgical assistant system and fundus imaging system. It allows us to capture images by OCT in real me, intraoperatively. Currently, in their data sheet, they refer to its usefulness mainly in surgical techniques, both for the anterior pole (DSAEK, DALK, follow-up of glaucoma surgery) and for the posterior pole (peeling of the internal limiting membrane, macular holes, epiretinal membranes, renal detachment). However, they do not highlight its use for exploration of these ocular structures during an examination under general anesthesia. Our pa ents were assessed under deep sedation. To obtain anterior segment images, we simply activate OCT mode and bring the microscope head closer to the ocular surface until the desired plane is focused. For posterior segment imaging, we apply viscoelastic to the ocular surface, we place in position the Resight device, which automatically activates the OCT mode on the microscope. We bring it closer to the surface, placing it 1 or 2 mm from the cornea, and we focus on the pupil under mydriasis. From there, although we do not visualize the background, we focus with the microscope pedal until we visualize and situate ourselves in the plane of the retina. Once in plane, we can do the fine focus in the parameters of the screen.

First case is a 2-year-old boy with esotropia since he was 6 months old, who comes to the clinic with prescribed glasses of +4.00D for both eyes, which he does not tolerate. It does not collaborate for taking visual acuity, nor for ophthalmological exploration, objectifying wide-angle esotropia. It was decided to explore in the operating room under sedation. We performed sciascopy, with a result of PN-12.00D in both eyes. No alterations were found in the anterior segment. The fundus of the eye is very hypopigmented and we can see slightly pale papillae and no foveal structure can be identified. It was decided to perform intraoperative OCT, which determined the diagnosis of bilateral foveal aplasia (Figure 1).

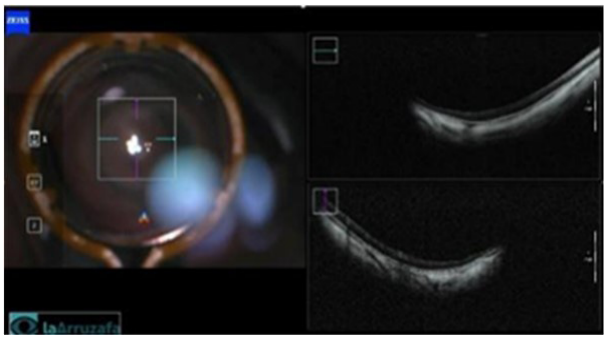

Figure 1: The diagnosis of bilateral foveal aplasia.

Second case is a two-week-old neonate with congenital corneal opacity in right eye, with no relevant family history, in which slit-lamp examination does not provide us with sufficient information, although we can verify corneal opacity. It was decided to explore in the operating room under sedation. It is not possible to perform sciascopy or assess the fundus due to media opacity. ECO is performed in which the applied retina and vitreous cavity can be seen within normality. Left eye has no alterations in the anterior or posterior segment. It was decided to perform OCT of the anterior segment to be able to evaluate the structures in detail and issue a possible diagnosis. OCT (Figure 2) reveals severe corneal opacity with increased corneal thickness, edema and severe fibrosis, Descemet's detachment, and lens-corneal contact at some points. Unstructured angle with anterior synechiae and flattening of the anterior chamber.

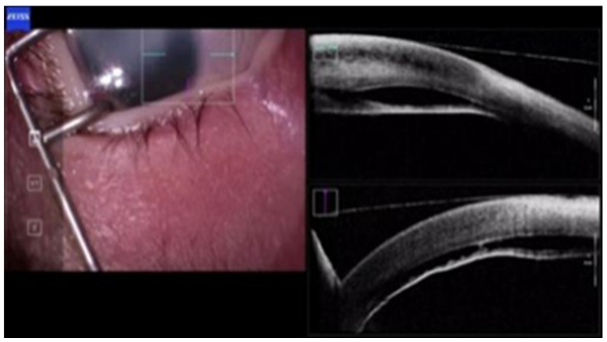

Figure 2: Severe corneal opacity with increased corneal thickness, edema and severe fibrosis, Descemet's detachment, and lens-corneal contact at some points.

Third case is about a child with congenital glaucoma who underwent surgery twice in another center, who went to see an optician in his city for detection of myopia. In the consulta on, it is possible to obtain a VA of 0.1 in the right eye and it does not help to obtain it in the left one. In the same way, it is not possible to perform sciascopy, nor take the IOP or perform an examination of the fundus. It was decided to explore in the operating room under sedation. Once sedated, sciascopy was performed, with a result of PN -11.00D in right eye and -8.00D in left eye. On exploration of the anterior segment, 14.5 mm horizontal and vertical megalocorneas are observed. The IOP is taken: 8 mmHg in AO. In the fundus, papillae with excavation 0.4 and 0.6 are observed, the excavation of le eye seems deeper. Intraoperative OCT (Figure 3) allows us to assess the degree of papillary excavation and whether it is symmetrical.

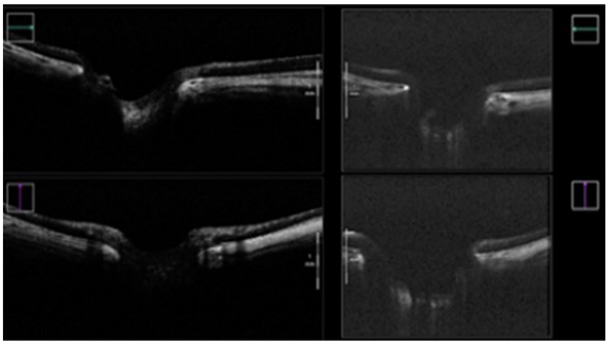

Figure 3: The degree of papillary excavation and whether it is symmetrical.

Discussion

The ophthalmological examination of pediatric patients is difficult and requires a lot of experience. Even so, there are cases in which the most experienced optometrist and the most expert ophthalmologist cannot perform their examinations on the children in consultation. The ophthalmological examination of these patients under sedation has clearly evolved with the incorporation of intraoperative OCT. Until its implementation, in patients in whom the ophthalmologist had reduced visibility of the anterior chamber of the eye, for example, due to congenital corneal opacities, intraoperative imaging was limited to Ultrasonic Bio Microscopy [5] (UBM) and photographs. With BMU we obtain a worse resolution and also if it is in the context of surgery, the surgical procedure must be stopped to be able to perform the exploration.

If we compare OCT devices integrated into surgical microscopes (MI-OCT) with portable OCTs, there are all advantages: Integration of intraoperative OCT control into the microscope foot pedal and above all, the combination of a highly magnified microscope image and high resolution OCT image.

Microscope-integrated intraoperative OCT provides important information during the anesthetic examination of some children. It brings the advantage that even with reduced visibility in the anterior chamber we can obtain high-resolution images of anterior segment structures (including cornea, camera angle, and lens). It allows us to evaluate alterations of the macula and the optic nerve in children who, due to their age or degree of collaboration, cannot perform an OCT in consultation. Is intraoperative OCT essential for an ophthalmological examination of a pediatric patient under sedation? No, but it is very useful. Perhaps in the future its use will be standardized as part of the pediatric examination under sedation.

Declarations

Patient consent: The family of the patients provided consent to publish details of these cases.

Conflicts of interests: The Authors declare(s) that there is no conflict of interest.

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