Laser Cataract Surgery: Curse of the Small Pupil

The introduction of the femtosecond laser is the latest step on the journey to refinement in cataract surgery, to ever more predictable refractive results, to a higher precision in the two crucial steps of the procedure (capsulotomy and lens fragmentation), and to higher patient satisfaction in a clientele that comes to us with the highest expectations in postoperative visual acuity. Most of us who are operating with a femtosecond laser, irrespective of which system, cannot help being astounded by the ease of the procedure and the increased safety for the patient, who is exposed to just a fraction of the ultrasound energy applied in conventional cataract surgery—and in many cases (91% of operations in one of our series)1 to no ultrasound at all.

However, there is one drop of bitterness in the chalice of femtosecond laser-assisted cataract surgery: the small pupil. If the pupil is smaller than the intended diameter of the laser-guided capsulotomy, the surgeon is in trouble. But from where do the causes of this problem arise—is it the patient or the laser? We consider it important for all cataract surgeons to use well-defined terminology to be able to discuss potential intraoperative or postoperative complications, their prevention, and their therapy—and refer to the same situation, the same challenges.

First, it is obvious that we should distinguish between a small pupil as a preexisting condition in the operating room (“pre” meaning before the laser was applied) and a miosis that sets in after laser treatment and thus, presumably, because of laser treatment. Poorly dilating pupils, despite intense application of topical mydriatics, usually occur in patients with comorbidities such as a hard lens, pseudoexfoliation, glaucoma, chronic uveitis, and zonular dehiscence, as well as after earlier surgery and in eyes with floppy iris syndrome. There are different ways to enlarge the pupil intraoperatively (eg, using epinephrine injection, iris retractors, or a Malyugin ring [MST, Redmond, WA], with or without ophthalmic viscosurgical devices) that we have described recently.2 Adequately employed, these techniques can render femtosecond laser-assisted cataract surgery safe and effective for these patients.

A narrow pupil after laser pretreatment basically means that the pharmacological dilation has been sufficient in the first place: the pupil at the beginning of the intervention has obviously been larger (usually greater than 5.0 mm) than the safety margins set for a safe capsulotomy (otherwise, the surgeon, or rather the system, would not have been able to perform accurate and safe laser pretreatment). It is these cases that have many cataract surgeons concerned, with incidences—a guess gained from conversations with other ophthalmologists—between 0% and 50%. Roberts et al. reported an incidence of 9.5% for their first 200 femtosecond laser-assisted procedures and a decrease to 1.23% in the subsequent 1,300 cases by additional instillation of a drop of 10% phenylephrine immediately after laser treatment.3 However, in our experience the incidence without the preoperative use of topical nonsteroidal anti-inflammatory drugs was 5% (n = 100) and decreased to 1% (n = 100) with nonsteroidal anti-inflammatory drug pretreatment.

The phenomenon of postoperative laser miosis is under evaluation; its causes are being discussed. Possible explanations are a sudden rise in the aqueous humor’s temperature immediately after the laser has been applied and the release of inflammatory mediators as a result of this temperature rise or of collateral effects of laser-induced shock waves. It seems from case reports that the more time that elapses between laser pretreatment and the beginning of intraocular surgery, the narrower these pupils become. Experienced surgeons recommend starting lens removal no later than 15 minutes after the laser has been turned off.4 The ophthalmic surgical community is currently testing countermeasures such as additional epinephrine injections and viscomydriasis.

Whatever the cause and whatever the cure, we should use coherent language in dealing with the problem of pupil diameters smaller than the diameter of the capsulotomy. Postoperative femtosecond laser-induced pupillary constriction seems to us to be a fitting term for all future discussions.

REFERENCES


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Clinical and Ultrasound Biomicroscopic Findings in a Patient With Anterior Vaulting of a Customized, Flexible Artificial Iris

The HumanOptics CustomFlex Artificial Iris (HOCFAI) (HumanOptics AG, Erlangen, Germany) is a customized, flexible iris prosthesis available as a fiber-backed or silicone-only model that can be inserted through a small, sub-3 mm, surgical incision for intra-capsular, sulcus, or suture fixation and secondary implantation with suture fixation. It has been implanted internationally in approximately 620 eyes over the past 10 years. (HumanOptics AG, unpublished data, 2013). There is high patient satisfaction and low incidence of complications postoperatively. We would like to share an unusual experience with this device.

An 18-year-old man with bilateral congenital aniridia, limbal neovascularization, and pannus suggestive of stem cell deficiency, progressive cataracts, and nystagmus suffered a lifetime of visual deficiency. He recently noted further visual decline.

The patient underwent uneventful cataract extraction by phacoemulsification with insertion of a posterior chamber, monofocal intraocular lens (IOL) in his left eye. Sequential implantation of the fiber-free HOCFAI, trephined to 10 mm in diameter, was achieved in the capsular bag. No capsular tension ring was implanted.

Corrected distance visual acuity (CDVA) improved to 20/30 in the left eye. On slit-lamp and ultrasound biomicroscopy (UBM) examinations, anterior vaulting of the prosthesis was noted along with mild capsular phymosis (Figure 1A). Sequential UBM examinations conducted at 2 (Figure 1B) and 3 (Figure 1C) months postoperatively confirmed the stability of the vaulting compared with its initial presentation. Despite this finding, the patient experienced no subjective visual disturbances, but rather observed a notable reduction in nystagmus, which further improved his quality of vision.

The patient underwent a similar procedure in his fellow eye. The surgical technique was modified to avoid postoperative anterior vaulting of the prosthesis. The HOCFAI was trephined to a 9 mm diameter instead of 10 mm. Seven months postoperatively, no vaulting or decentration of the IOL or iris prosthesis in the fellow eye was detected (Figure 2A). Twelve months postoperatively, CDVA was 20/30 in the fellow eye and the vaulted prosthesis in the initial eye remained stable as visualized by UBM microscopy and clinical evaluation (Figure 2B).

In our case, UBM imaging demonstrated a unique...
incidence of anterior vaulting of a HOCFAI secondary to capsular phymosis in a congenitally aniridic eye. Because of their onset, both the phymotic capsule and the vaulted prosthesis have remained stable as demonstrated by sequential UBM studies, therefore obviating the need for further intervention. However, reduction of the diameter of the trephined prosthesis in the fellow eye prevented postoperative anterior vaulting of the iris prosthesis and capsular phymosis, thus demonstrating the effectiveness of this surgical modification.

The patient continued to have CDVA of 20/30 in both eyes and was extremely satisfied by his visual and cosmetic results (Figures 3A-3B). The IOLs remained well centered within the capsular bag bilaterally. Stability and position of the prosthesis and capsular bag will be monitored using UBM imaging, given the technology’s high sensitivity.

REFERENCE


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