Use of a Microvascular Clip for Iris Fixation of an Intraocular Lens

A Laboratory Model

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Here we present a potential novel surgical technique consisting of fixation of a posterior-chamber intraocular lens to the iris that may be used in the treatment of aphakia or the management of intraocular lens complications when capsular support has been compromised. The technique was performed in a laboratory model using cadaveric human eyes. A commercially available neurovascular clip was used to securely fasten the intraocular lens to the iris with minimal trauma. The use of a metal clip has the advantage of avoiding potential risks of suture fixation such as suture breakage. Also, this technique is easier than suturing and may potentially serve as another tool in a cornea surgeon’s armamentarium.


Suture fixation of a posterior-chamber intraocular lens (IOL) is the preferred technique in the management of aphakia when posterior lens capsular support is not adequate. Currently, 2 types of suturing techniques are used: iris fixation and scleral fixation.1-5 Although initially it was widely presumed that the iris-fixated IOL loops were directly positioned within the ciliary sulcus,6,7 postmortem clinicopathological studies of iris-sutured posterior-chamber IOLs demonstrated that the IOL loops are seldom situated within the ciliary sulcus, and the IOL relies principally on the fixation sutures for support.8 Therefore, proper long-term positioning of these IOLs depends largely on the integrity of the sutures. Subluxation of these iris-fixated IOLs is not infrequent and becomes a serious problem during long-term follow-up.9,11 In fact, we reported a subluxation rate of 7.1% over an average period of 4 years using the polymethylmethacrylate IOLs with positioning holes in the optic and 10/0 Prolene sutures.11

The exact mechanism of subluxation of suture-fixated IOLs is unclear, and multiple mechanisms may be involved. Untying of the suture is one possibility and is usually recognized in the immediate postoperative period.1 Erosion of the knot or the suture through the iris, or “cheesewiring,” can also occur, largely owing to fibrotic changes occurring within the iris stroma surrounding the suture,12 particularly in patients with preexisting conditions that predispose them to iris atrophy such as pseudoxefoliation or uncontrolled diabetes mellitus with iris ischemia and/or neovascularization. Degradation of a polypropylene suture including wrinkling, flaking, and localized transverse cracking, especially in areas where the suture was in contact with the sclera and ciliary sulcus, has been documented.9,13 These changes were noted to increase with time spent in vivo and with placement of the suture in more metabolically active tissues such as the ciliary body or iris vs sclera.13 Another mechanism is microabrasion from long-term friction and slicing of the fixation sutures over the edge of the positioning holes or eyelets, resulting in late breakage.14 The difficulty of the technique and the length of surgical time during suture fixation of the IOL are also considerable. Therefore, the search for safer alternatives continues.
Here we present a technique for fixation of posterior-chamber IOLs to the irises of eyes without adequate capsular support in a laboratory model using explanted human cadaveric eyes.

METHOD

A Miyake microscope setup to view the internal parts of the explanted globe was assembled as previously described. Human cadaveric globes not suitable for transplantation were acquired from a local eye bank and kept in a moist chamber. The globes were prepared for Miyake microscopy by sectioning at the equator using a razor blade as previously described. The vitreous body, retina, and choroid were removed using a pair of forceps, retaining only the lens, ciliary body, and iris. The eviscerated, sectioned globe was then mounted on a clear Petri dish in a modification of Miyake's original technique. An open-sky intracapsular cataract extraction was then performed. A flexible acrylic IOL was folded using the moustache fold technique, and the haptics were inserted posterior to the iris and into the ciliary sulcus. A Barraquer sweep was used to support the optic anterior to the iris plane as the lens unfolded. The Barraquer sweep was then used to elevate the optic to facilitate visualization of the haptics posterior to the iris. Once the optic of the IOL was captured by the iris, the haptic and overlying iris were grasped with retinal forceps. A commercially available 0.9-mm neurovascular clip (AnastoClip VCS; Le Maitre Vascular, Inc, Burlington, Massachusetts) was deployed, clipping the IOL haptic in the midperipheral iris. The same procedure was then repeated with the opposing haptic. Finally, the lens was swept posterior to the iris and positioned securely within the sulcus.

RESULT

In the explanted human globes, the posterior view confirmed that the haptics were positioned within the ciliary sulcus and showed that both clips were tightly wrapped around the haptics (Figure 2). There was no tilt or decentration of the IOL. The clips did not grasp an excessive amount of iris tissue, distort the pupil, or cause any additional trauma (Figure 3). No mechanical problems were encountered during the deployment of the clips (video; http://www.archophthalmol.com). The procedure was technically easy and took a short amount of time to perform. The IOL was secured with good strength when tested with the Barraquer sweep.

COMMENT

The surgical technique described here using AnastoClip VCS was successful in fixing a posterior-chamber IOL to the iris in this laboratory model. AnastoClip VCS is used in arteriovenous access grafting, vascular repair, peripheral bypass grafting, and fistula surgical procedures with documented improved patency and reduced rates of revision. This can be attributed to the...
fact that the clips are inert and do not actually puncture the vessel wall; hence, they cause no inflammation or necrosis of the tissues at the clip site. These clips were originally designed for blood vessel anastomoses, but have also been used successfully in ureter and bile duct anastomoses. AnastoClip VCS has several different designs. The design that was used here is model 4000-05, the smallest size. The cartridge measures approximately 3 mm in width and holds 40 clips (Figure 4). Each clip measures approximately 0.9 mm in width and weighs 0.46 mg. Of note, a 3-piece posterior-chamber IOL suitable for iris fixation such as the model used in this study measures approximately 24.5 mg, making a pair of clips less than 5% of the total weight on the iris. Therefore, pseudophakodonesis or distortion of the pupil in cases where the clip was applied appropriately would be unlikely. There is a potential risk of corneal endothelial damage over time but it would be unlikely considering the positioning of the clips, especially in the absence of any intraocular inflammation or chemical changes in the material itself. Use of titanium has been studied extensively in the field of medicine. It is generally considered a permanent, inert material with no concerns regarding long-term toxicity or durability. In the field of ophthalmology, titanium has been used as a part of the Boston keratoprosthesis locking mechanism since March 2004 (Claes Dohlman, MD, PhD, oral communication, March 24, 2009). To date, no reports of any adverse effects have been encountered regarding the titanium ring that serves as the locking mechanism.

The technique we describe here is the first step toward establishing the use of titanium vascular clips intraocularly as a method for securing posterior chamber IOLs. The device, in its current state, could be considered in IOL exchange during a penetrating keratoplasty, thereby eliminating the risk of suture breakage. The technique is simple and requires much less time compared with suture fixation. Long-term studies in live animal models are under way to determine the stability and potential risk of iris atrophy at the site where the clips are deployed.

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