Posterior optic capture of intraocular lens in difficult cases of pediatric cataract

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We describe the technique of posterior optic capture without anterior vitrectomy in two difficult cases of pediatric cataract. We demonstrate how a three-piece foldable intraocular lens can be maneuvered behind the posterior capsule after an improvised posterior capsulotomy. This technique provided excellent intraocular lens (IOL) stability with the absence of lens epithelial cell proliferation in infants with altered posterior capsule morphology.

Key words: Lenticonus, optic capture, pediatric cataract, persistent fetal vasculature

Surgical Technique

Posterior capsulorhexis with anterior vitrectomy is the standard of care in pediatric cataract to prevent the inevitable posterior capsular opacification. The overall goal is to provide a strong margin to the opening to hold the intraocular lens (IOL) in the bag. However, in some cases of pediatric cataract, the formation of a continuous curvilinear posterior capsulorhexis requires or ends up in a larger opening. These conditions include cases where the posterior capsule is weak as in the posterior lenticonus or a cataract with persistent fetal vasculature (PFV) where the removal of the central plaque leads to a bigger opening in the posterior capsule and the IOL implantation in the bag leads to instability. Surgeons often resort to sulcus implantation of the IOL in such conditions which is fraught with complications such as more inflammatory sequelae, iris chafing, and glaucoma. Posterior optic capture of the IOL has been described as a promising technique in children which obviates the need for additional procedures required due to visual axis obscuration. In our recent randomized study in children, posterior optic capture without anterior vitrectomy has been shown to be better than in-the-bag IOL implantation in reducing inflammatory sequelae and is equivalent in terms of visual axis obscuration.

Herein, we report the successful use of this technique in children with pathology in the posterior capsule where a posterior capsular opening was modified in a way to allow the prolapse of the optic as endocapsular IOL implantation could have been counterproductive. This resulted in a stable IOL with no lens epithelial cell (LEC) proliferation in the visual axis.

Surgical Technique

The initial few steps of the surgery are the standard steps followed in pediatric cataract surgery. They involve making two limbal side port tunnels made at 3 and 9 o’clock positions using a 15-degree paracentesis knife, staining of the anterior capsule, a posterior limbal incision made with a 2.8 mm keratome knife, and continuous anterior capsulorhexis of approximately 5.0 mm diameter performed with utrata forceps. The aspiration of the lens is accomplished using an automated handpiece. The primary posterior capsulorhexis (PPC) made is 4–5 mm which is slightly larger than a conventional PPC. No anterior vitrectomy is done. The IOL is initially placed in the bag, and thereafter, the optic is pushed down inferiorly and then superiorly or sideways through the PPC, creating an ellipsoidal opening with haptics in the bag. The position of the IOL behind the posterior capsule can be confirmed by the spindle shape of the posterior capsule. All ports are then sutured.

Case 1

A one-year female child had posterior lenticonus [Fig. 1a] with no abnormality in the fundus. The child was taken up for left eye cataract surgery with a plan for primary IOL implantation [Video 1]. At the time of the surgery, the area of the lenticonus

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was well-defined as a bowed central opacification [Fig. 1b]. Posterior capsulorhexis was performed with utrata forceps along the circumference of the pathology with an aim to keep it large enough to accommodate the optic but without any peripheral extension. A three-piece hydrophobic acrylic IOL was implanted into the capsular bag, and thereafter, the optic was caressed behind the posterior capsule resulting in an oblong posterior capsular opening [Fig. 1c]. The position of the IOL behind the posterior capsule was confirmed by the spindle shape of the posterior capsule. At follow-up, the IOL was stable and well centered. There was no visual axis proliferation due to the lens epithelial proliferation [Fig. 1d]. However, one sector had iridolenticular adhesions and some pigments on IOL.

Case 2
A seven-month male child was found to have a central dense cataract with a stalk running from the lens to the optic disc on ultrasound. The child was planned for right eye phacoaspiration and IOL implantation [Video 1].

During surgery, after aspiration of the cataractous lens, PFV was visible as a stalk attached to the posterior surface of the opacified capsule [Fig. 1e]. As the posterior capsule was fibrotic, we used a vitrectomy cutter to create an opening removing the fibrotic area and extending into the clear zone so that the optic could easily go through [Fig. 1f]. In this process, the attachment of the stalk to the posterior capsule was also removed. A three-piece hydrophobic acrylic IOL was carefully guided into the capsular bag followed by a gentle prolapse of the optic margin through the posterior capsular opening [Fig. 1g]. Postoperatively, the visual axis remained clear at the 6-month follow-up visit [Fig. 1h].

Discussion
Challenging cases of pediatric cataract pose a surgeon with perplexity. Posterior lenticonus and PFV are conditions where the posterior capsule morphology is altered. The capsule may be thin, floppy, fibrotic, or deficient in places. There are reports that even in the presence of an intact capsule, sulcus fixation is often preferred because of the suspected fragility and eccentricity of the posterior capsule. In cases which do not have a defect, sulcus fixation is chosen in up to 20% of the eyes. Wilson et al. suggested to avoid any extension of the opening in such cases. However, we converted this defect into a large capsulorhexis without any peripheral tear and successfully accommodated the IOL. In patients with PFV-associated cataract, primary IOL implantation is not done in many cases, and in cases where it is done, a large proportion has sulcus implantation of IOL. Secondary IOLs are favored in these already glaucoma-prone eyes.

The technique of posterior optic capture that we describe can be successfully performed in cases with posterior capsular abnormalities. A manual posterior capsulorhexis larger than 4 mm is attempted to surround the area of the bulge or
vascularized opacity. On the other hand, an already ruptured capsule can be converted or extended to a posterior capsulorhexis and a three-piece IOL captured posteriorly without the need for vitrectomy. In one of the discussions on pediatric cataract surgery in posterior lenticonus, most of the surgeons commented that they would avoid vitrectomy if possible in these eyes.[4] Preserving the anterior vitreous phase will help us in maintaining the barrier between aqueous and vitreous.[5] There are many other benefits of not touching the vitreous face. An anterior vitrectomy in a child can increase the risk of the enlargement of posterior capsulotomy,[6] cystoid macular edema,[7] and retinal detachment. Vitreous strands entering the incision may increase fibrinous complications. It is often difficult to quantify the “adequacy” of vitrectomy. The existing evidence is insufficient as to what is the effect of removing vitreous in a growing eye,[8] Oxidative stress and damage with vitrectomy may also contribute to the increased risk of glaucoma in the immature trabecular meshwork of the pediatric eyes.[9] Even after adequate anterior vitrectomy, the chances of visual axis obscuration are still present in the cases of pediatric cataract.[10] Hence, not performing anterior vitrectomy eliminates the complications associated with disturbing the vitreous and preserves the vitreous in a growing pediatric eye. Also, locking the IOL is a better option in cases of large posterior rhexis where there is a risk of IOL being unstable in the bag with a tendency to dislocate in the vitreous over a period of time.

The technique has a learning curve over the other techniques of IOL implantation. The sizing and centration of anterior capsulorhexis must be kept in mind. We should ensure that no vitreous tags are left in the margin of the rhexis as well as the pupil. The material and edge design of the optic are less important with this technique to counteract visual axis obscuration in children. Posterior optic capture avoids the proliferation over the anterior hyaloid phase as well as LEC migration due to the fusion of the anterior and posterior capsules which was evident on follow-up.

**Conclusion**

Posterior optic capture of intraocular lens technique is a promising alternative to the previously described procedures in cases where the posterior capsule is abnormal in morphology, be it fibrotic as in PFV or friable as in posterior lenticonus and where endcapsular implantation risks instability.

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**Conflicts of interest**

There are no conflicts of interest.

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