• Letter to the Editor •

Combining pars plana vitrectomy with insertion of scleral fixated IOL and penetrative keratoplasty—an alternative approach

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Dear Editor,

Although not usually fatal, ocular injuries are a significant global concern, leading to permanent disability and accounting for a considerable number of cases of unilateral blindness. Severe pathology of the lens and the cornea may occur as a result of ocular trauma. In complicated cases with aphakia and corneal pathology requiring penetrating keratoplasty (PKP), when capsular support is deficient or absent, combined techniques of PKP and intraocular lens (IOL) implantation are recommended[1-2]. Patients with complex problems in the anterior and the posterior segment of the eye may be predisposed to vitreous complications, and combining PKP, IOL insertion, and pars plana vitrectomy (PPV) could help prevent potential vitreous prolapse, vitreous hemorrhage, or retinal detachment[3]. The combined PPV, IOL and PKP procedure include a safe and effective approach for eyes requiring anterior and posterior segment surgery, with shorter rehabilitation time[3].

Depending on the surgeon's experience, competence, the patient and eye's condition there are numerous options of IOL implantation available, including anterior chamber IOL (AC-IOL), iris-sutured or iris-fixated IOL, sutured or sutureless, scleral-fixated (SF) 3-piece IOLs, or the innovative Carlevale IOL (FIL-SSF, Soleko, Italy)[1,4]. In posttraumatic cases it is common that the iris diaphragm may be missing making AC-IOL or iris-fixated-IOL implantation unsuitable for these patients[1]. While both sutured and sutureless implantation methods have been reported in the literature, the latter is currently gaining popularity, when capsular support is inadequate. Crucial advantage of sutureless (Carlevale) IOL fixation is the avoidance of suture-related complications, including infection, suture rupture or inflammation[1,5-6].

Although the triple procedure has been previously described using the Carlevale IOL, in this paper we present an alternative approach of the same surgery in a patient with posttraumatic aphakia and diffuse corneal edema[7-8]. The technique includes a PPV, insertion of a Carlevale IOL and PKP. To our knowledge this is the first description of this specific approach of this triple procedure in literature.

Ethical Approval This retrospective review of patient data did not require ethical approval in accordance with local/national guidelines. In addition, the principles outlined in the Declaration of Helsinki and its later amendments have been followed. The patient also consented for the publication of this report including photos and video. Written informed consent was obtained for anonymized patient information to be published in this article.

Case Presentation A 58-year-old male was referred to our clinic with a history of aphakia, after trauma in his left eye and surgery at the age of 13. At the age of 19 with the use of an aphakic contact lens his best corrected visual acuity in the left eye was 0.16 logMAR. On presentation his best visual acuity in the right eye was -0.1 logMAR and counting fingers in the left. Slit-lamp examination of the left eye revealed aphakia with diffuse corneal edema and bullae, pertaining to aphakic bullous keratopathy (Figure 1). The anterior chamber was deep and a vitreous band was present temporally. The examination of the right eye was unremarkable. Intraocular pressure was 12 and 13 mm Hg in the right and left eye, respectively. Fundus examination of the right eye was normal. Since we

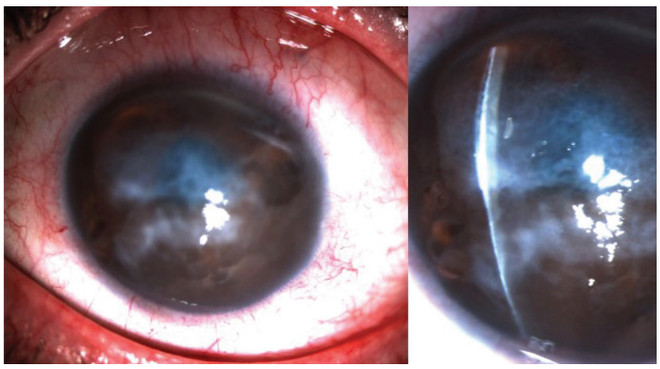


Figure 1 Preoperative picture of the left eye showing bullous keratopathy.

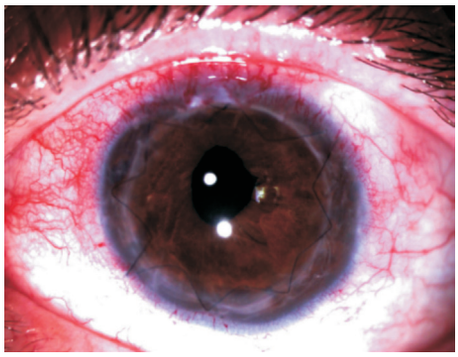


Figure 3 Postoperative picture showing corneal sutures and clear cornea.

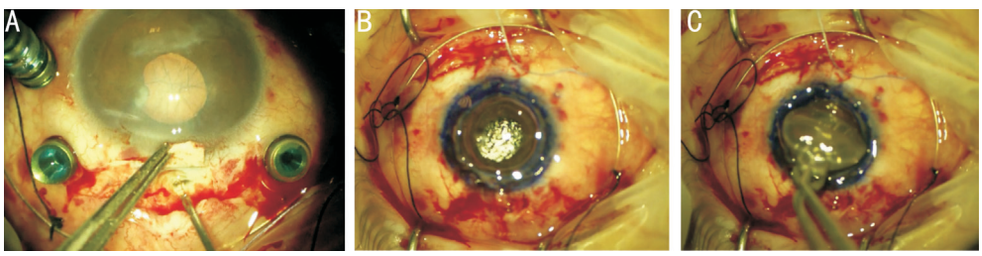


Figure 2 Surgical procedure A: Intraoperative picture during externalization of the trailing haptic of the scleral fixated intraocular lens; B: Intraoperative picture right after removing the patient's cornea, "open sky"; C: Intraoperative picture during positioning of the donor cornea.

were unable to examine the fundus of the left eye, a B-scan ultrasonography was performed which was normal excluding any retinal detachments or mass.

Surgical Procedure The surgical approach was discussed with the patient. The surgical plan involved a combination procedure including a complete PPV with concomitant insertion of a Carlevale IOL (FIL-SSF IOL, Soleko, Italy) and PKP, for which the patient consented. Initially, a Flieringa ring was placed in order to provide structural support of the eye during corneal transplantation. After placing three 23G trocars at 3.5 mm from the limbus for PPV, the corneal epithelium was scraped in order to increase visualization to perform the vitrectomy. Fortunately, adequate visualization was achieved in order to complete the surgery while we avoided insertion of a temporary keratoprosthesis, which was a key factor in performing this surgical approach. The total posterior PPV was completed and two scleral flaps (2 mm) were created in order to house the T-shaped haptics of the Carlevale IOL. Using a micro vitreoretinal (MVR) blade sclerotomies were performed under each scleral flap. Through a 2.75 mm corneal incision, the IOL was injected into the anterior chamber and by using intraocular forceps through the sclerotomies under the scleral flaps, the leading haptic was externalized. The trailing haptic was externalized in a similar fashion using the other scleral flap sclerotomy (Figure 2A). The scleral flaps were sutured using 8-0 nylon sutures. After the insertion of the IOL the cornea team took over creating an 8 mm trephination of the cornea, removing the recipient's cornea and inserting an 8.5 mm donor corneal button (Figure 2B, 2C). The donor cornea was sutured using 10-0 nylon sutures. The surgical procedure is shown in the uploaded video (Video 1, online supplementary).

The surgical process was completed without any intraoperative complications. Up to 2y after the surgery, the lens was well-centered and best corrected visual acuity of the left eye was 0.4 logMAR (-5.0 cyl at 126°). No signs of failure or rejection were evident and the graft remained clear with an adequate endothelial cell density of 1877 cells/mm² (Figure 3). Overall, the patient was satisfied with the outcome with improved vision in his left eye.

DISCUSSION

Surgeries combining multiple procedures are currently considered beneficial in terms of safety and visual outcomes for eyes with challenging conditions. The most appropriate approach for secondary IOL implantation during PKP in an eye with inadequate capsular support remains controversial. Although technically easier and more time efficient, AC-IOL implantation adds a higher risk for postoperative complications, including graft failure, prolonged inflammation, corneal decompensation, elevated intraocular pressure, cystoid macular edema, hyphema, and others[1,9]. In cases of aphakia and absence of capsular support, PKP combined with iris-claw fixated IOL insertion is favored due to its safety and technical simplicity. However, when severe iris damage or atrophy is present, iris-claw fixated IOLs are not a suitable choice[10].

Numerous reports of combined methods of PKP and scleral sutured IOLs have been described[2]. Insertion of the IOL in the posterior chamber (PC) in the ciliary sulcus may cause less endothelial cell and trabecular meshwork damage. This is because, theoretically, it positions the lens in an anatomic area similar to that of the physiological of the crystalline lens[2]. Al-Qatani[11] described a combined approach of PKP and IOL insertion that allowed the PC-IOL fixation with transscleral sutures under closed anterior chamber. During a technically challenging surgery on an aphakic patient with microphthalmia and microcornea, Li *et al*[12] utilized a unique technique by piercing the IOL's optic and suturing it through the created opening to the sclera, all performed during corneal transplantation under open-sky conditions. Transscleral IOL fixation during PKP has positive visual outcomes for the patients. The presence of sutures, though, increases the risk for complications, such as suture erosion, lens dislocation due to suture rupture and suture infection, or inflammation. Additionally, glaucoma, cystoid macular edema, and retinal detachment have also been described[1-3,5].

The need to avoid suture-related difficulties profoundly increased the use of sutureless fixation strategies[13]. Sinha *et al*[6] presented in small case series the fibrin glue assisted intrascleral fixation of PC-IOLs as a stable and safe procedure when combined with Descemet's stripping automated endothelial keratoplasty (DSAEK) or PKP in different patients. In their study Karadag *et al*[5] described a trocar-assisted sutureless intrascleral haptic fixation combined with PKP. This approach eliminates the need for peritomy or scleral flaps, leading to a quicker procedure and preserving the conjunctiva for potential future interventions. The Carlevale IOL has lately revolutionized sutureless scleral fixation with its T-shaped haptics which anchor the sclera allowing excellent fixation[9,13-15]. Petrelli *et al*[7] demonstrated the combination of PKP and Carlevale IOL insertion using an open-sky approach in non-vitrectomized eyes, which removes the necessity for injecting the lens through small corneal incisions and thus simplifies the procedure. While this method shows promise for restoring vision in aphakic patients with corneal pathology, it presents increased intraoperative risks due to the lack of a barrier between the vitreous cavity and the anterior chamber. Additionally, without a complete vitrectomy, the theoretical risk of retinal detachment remains elevated. On the other hand, the surgery is completed solely by a single anterior segment corneal specialist without the need for a vitreoretinal surgeon. de Angelis *et al*[8] performed the same procedure (PKP+Carlevale IOL) in previously vitrectomized eyes with extended follow-up period, confirming the beneficial outcomes. Nevertheless, this unicameral approach during open-sky surgery still carries a risk of intraoperative complications[13]. It is understandable that in such cases there is a need to remove the diseased-opacified cornea soon in order to have visualization to complete the surgery. In our case the approach used was based on the fact that we did have adequate visualization after scraping the corneal epithelium and there was no need for a temporary keratoprosthesis.

Therefore, our intention and our surgical novelty was to avoid a unicameral open-sky surgery when positioning the IOL, *i.e.,* having no barrier between the AC and the vitreous cavity. Therefore, our initial step of the procedure involved PPV and Carlevale IOL insertion through a small corneal incision (2.75 mm). A temporary keratoprosthesis was not required for the completion of the vitrectomy and IOL fixation. Having the Carlevale IOL fixated and in place, thus forming a barrier between the two cavities, the cornea team was able to perform a PKP as usual. Therefore, the open-sky surgical time was kept to a minimum while having an IOL barrier in place. As a result, the danger for related complications, including expulsive choroidal hemorrhage and vitreous prolapse (if not vitrectomized eye) was diminished. Performing a complete posterior PPV with scleral fixated IOL insertion and PKP is important in an attempt to decrease the risk of retinal detachment that a partial anterior vitrectomy may cause during IOL insertion.

Consequently, although a more extensive evaluation of the results is needed, our surgical technique may illustrate an efficient strategy for managing such complex cases. Although a variation of this triple surgery has been described previously, we believe that our novel surgical approach diminishes potential intraoperative and postoperative complications which in the end will improve patient care.

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