

Trans-scleral plugs scleral fixation IOL and penetrating keratoplasty to restore vision in vitrectomized eyes

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Abstract

Purpose: To report the surgical outcomes of penetrating keratoplasty (PKP) and sutureless scleral fixation (SSF) using Carlevalle Lens (Soleko) combined procedure to solve corneal failure and aphakia in vitrectomized eyes and discuss eventual advantages of this new approach.

Methods: Two patients underwent primary wound repair and pars plana vitrectomy after a penetrating ocular trauma and were referred to the author's clinic. The PKP and SSF-Carlevalle lens implantation were performed under retrobulbar anesthesia. Intraoperative and postoperative complications were recorded, intraocular lens positioning was evaluated using anterior segment optical coherence tomography (AS-OCT) and endothelial cell density was determined using an endothelial microscope. Both patients completed 12 months follow-up.

Results: The surgery was performed without intraoperative complications. After 1 month, the lens was fixed well, and the graft showed no sign of rejection. At the last visit after 12 months, the corneal graft remained transparent with good endothelial cell density in both cases; conjunctival scarring or inflammation and plugs externalization did not occur during follow-ups. Best-corrected visual acuity was 4/10 Snellen in the first case, while in the second case, we witnessed a limited visual recovery of 1/20 Snellen due to retinal issues.

Conclusion: We report the feasibility of secondary IOL implantation using Carlevalle with penetrating keratoplasty. The relative ease of Carlevalle lens implantation through the transscleral plugs reduces the open globe length resulting in a safer procedure, especially for vitrectomized eyes.

Keywords

Penetrating keratoplasty, cornea/external disease, IOLs, lens/cataract, postoperative anterior segment problems, secondary IOL implantation, surgery with high-risk ocular conditions

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Introduction

Ocular trauma is a frequent cause of visual disability, depending on the population considered, up to 65% of the cases of unilateral blindness worldwide. After an ocular trauma, coexisting visually significant corneal pathology and lens issues are not rare.¹ When a penetrating keratoplasty (PKP) is performed in an eye with inadequate or absent capsular support, several approaches have been proposed to implant an intraocular lens (IOL).^{2–4}

Anterior chamber IOL or iris-fixated or scleral-fixated IOLs can be used to rehabilitate the aphakic eye. Both

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anterior chamber and iris-fixated IOL require mostly intact iris diaphragm, which is a post-penetrating ocular trauma can be missing.⁵ These lenses are implanted in an open sky method. Currently, sutureless scleral fixation (SSF) has gained popularity in eyes with insufficient capsular support, because they can avoid suture-related infection or inflammation and breakage of the suture with subsequent IOL dislocation. Sutureless scleral fixation (SSF) techniques combined with PK have already been published.

Recently, the introduction of an SSF scleral plug IOL Carlevale lens represents a new valid option for the management of the absence of capsular support. The implantation of this lens differs from all approaches previously proposed and, for this reason, might have some benefit for this challenging surgery. However, there is a lack of evidence regarding the use of this in lens among these complex cases.

In this paper, we report the use of this new lens for the management of aphakia and corneal scarring in absence of capsular support of two vitrectomized eyes and the eventual advantages of this in the procedure.

Cases reports

Our institutional review board (IRB) approved the study and the consent to publish this case report was obtained by the patient; furthermore, this report does not contain any personal information which could lead to the identification of the patient.

Two eyes of two patients who underwent PK and SSF using Carlevale IOL combined procedure for a history of penetrating ocular trauma (POT) with aphakia and corneal scarring were included in the study.

The first case was a 30-year-old man previously undergone primary wound repair and pars plana lensectomy/vitrectomy with silicon oil (SO) after POT resulting in inferior corneal wound, post-traumatic aniridia and cataract with multiple retinal breaks.

The second case was a 74-year-old woman with a history of multiple surgeries including PPV with SO and PK after POT causing corneal wound, IOL extrusion and retinal detachment.

Clinical and demographic details are shown in Table 1.

Surgical procedure

The PKP and SSF-Carlevale lens implantation were performed as described briefly below; the surgery was performed under general anesthesia and was similar in both cases. (Figure 1). Before the surgery, the 0–180° axis was marked at a slit lamp. The cornea was marked with a tissue marker. A partial conjunctival peritomy was performed in correspondence of the marked axis, and two self-sealing pockets were sculpted with a crescent blade making two straight incisions that run posteriorly from the limbus for

Table 1. Clinical and demographics details.

	Case 1	Case 2
Age	30	74
Follow-up		
Sex	M	F
Indication	Corneal decompensation	Corneal graft failure
Preexisting ocular conditions	Aphakia POT	Aphakia POT/RD
History of ocular surgery	PRW LE + PPV + SO	PRW + PPV + SO PK + SO removal
Preop		
BCVA	HM	LP
IOP	13	15
Postop (last visit)		
BCVA (Snellen)	4/10	1/10
IOP	17	12

BCVA: best corrected visual acuity; HM: hands motion; LP: light perception; PK: penetrating Keratoplasty; POT: penetrating ocular trauma; PRW: primary repair of the wound; RD: retinal detachment; SO: Silicon oil.

2 mm at 0° and 180° axis, and then dissecting the sclera making two opposite pockets for each side. Two 23/25 G trocars were placed from 1.5 mm to 2.0 mm from the limbus in correspondence of 0–180° axis. The diseased host cornea was trephined at 8.0 mm diameter. The leading plug was grasped with a vitreoretinal forceps inserted into the vitreous chamber through the sclerotomy, and the lens was positioned into the eye without folding the lens in the cartridge, then the trailing plug was grasped with two forceps and externalized.

A donor corneal button 0.5 mm larger than the recipient bed was placed onto the host corneal bed and sutured with Nylon 10/0 (Figure 1, Supplement Video 1).

The surgery was performed without intraoperative complications. After 1 month, the lens was fixed well, and the graft showed no sign of rejection. At the last visit after 12 months, the corneal graft remained transparent with good endothelial cell density of 1895 cell/mm² and 1673 cell/mm² respectively; conjunctival scarring or inflammation and plugs externalization did not occur during follow-ups. Anterior segment OCT showed a correct slope of the lens without tilt (Figure 2). Best-corrected visual acuity was 4/10 Snellen in the first case, while in the second case, we witnessed a limited visual recovery of 1/10 Snellen due to previous retinal detachment.

Discussion

In patients with absence of capsule support and who underwent penetrating keratoplasty, the most appropriate method of secondary IOL implantation remains controversial.

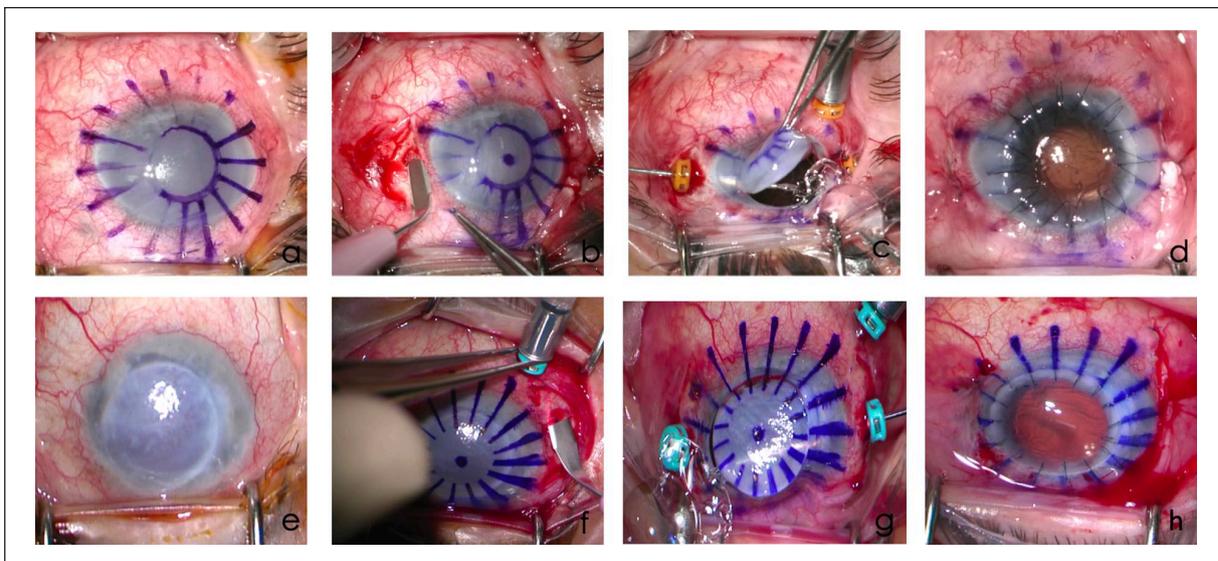


Figure 1. Surgical steps of PKP and SSF Carlevalle Lens implantation combined procedure: Scleral pockets sculpting (b;f). Leading plug grasping using a vitreoretinal forceps (c;g). Final result at the end of the surgery (d;h). Case 1: a–d; Case 2: e–h.

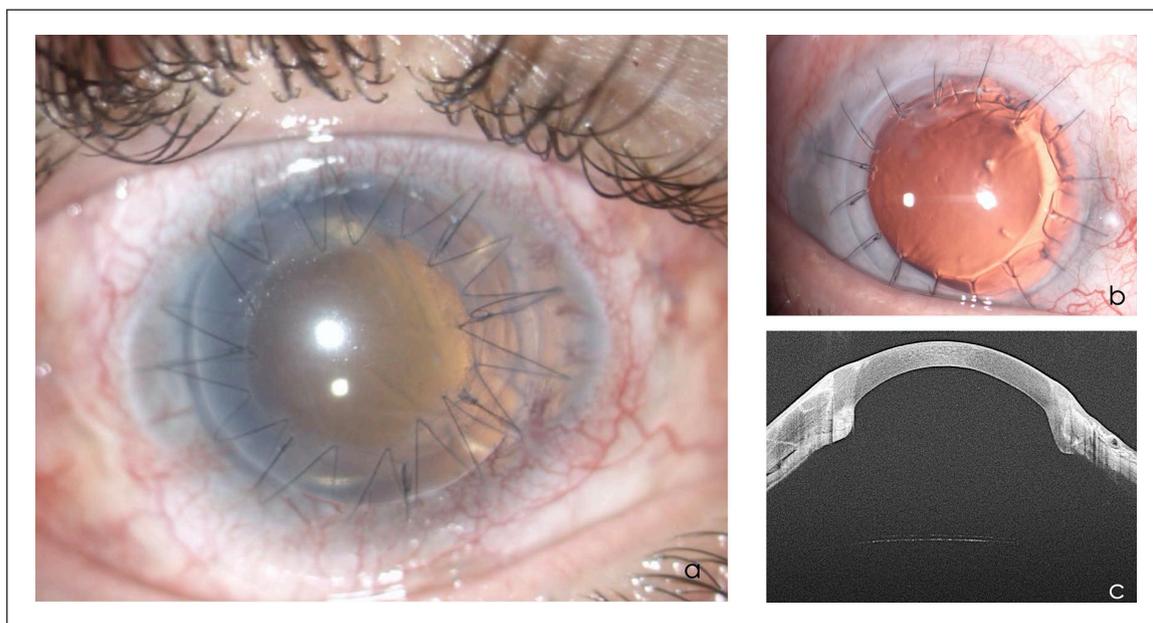


Figure 2. After 12 months the corneal graft is transparent and SSF IOL Carlevalle lens well positioned (a and b). Anterior segment OCT shows the correct positioning of the lens without tilt (c).

The use of iris-claw lens represent a valid approach in the treatment of aphakia and has remarkable advantages especially when associated with PK; indeed the ease of iris enclavation with via open sky without the needs of suture or haptic externalization results in shorter operation time compared with the traditional sutured scleral fixation approach. However this technique cannot be used in cases of aniridia or in eyes with extensive iris damage because of trauma or surgery.⁶ In both cases presented, the POT resulted also in an extended loss of iris tissue with anterior

sinechie such as to render any attempts of pupilloplasty unperformable.

Conventionally, transscleral suturing of a posterior chamber IOL (sutured IOL) combined with PK has been described in aphakic corneal pathologies. Problems with a sutured IOL include the relatively long learning curve and the prolonged intraoperative manipulation that might be associated with a risk of choroidal effusion or expulsive hemorrhage, especially in an open-sky eye. Recently, SSF IOL implantation has begun to be used more often because

it is easier to perform and does not cause suture-related complications.⁷

Karadag et al.⁸ have already discussed the eventual benefits of intrascleral haptic fixation in combined procedure with PK, consisting of the absence of the scleral flap and of suture-related problems, such as suture degradation, also resulting in a less time-consuming surgery. Additionally, according to the authors, avoiding peritomy might represent an advantage since the conjunctiva remains untouched for possible further surgeries. However, this technique has unique complications such as early spontaneous IOL dislocation, persistent hypotony, subconjunctival haptic, and conjunctival erosion due to haptic exposure.^{7,9}

Recently, a new way for scleral fixation through transscleral plug IOL Carlevale lens has been proposed in the treatment of aphakia with good results in terms of fixation and complication rate.^{10,11}

The most interesting aspect of the use of this lens in an open sky set is that the plugs are grasped outside the eye and subsequently externalized without folding the lens into the cartridge; this deeply simplifies the scleral fixation of this IOL, which generally involves the lens injection through a small corneal incision of 2.2 or 2.75 mm together with the externalization of the leading plug grasped inside the eye with a vitreoretinal forceps. In addition, as already discussed in other reports, it is important to highlight that avoiding haptic manipulation results in shorter surgery; this represents a remarkable advantage since this procedure was performed in vitrectomized eyes. After plugs externalization, the lens is firmly anchored to the sclera; indeed, even if during the surgery a scleral collapse happens, IOL dislocation will not occur differently from the intrascleral fixation of 3-piece IOL, where a haptic slippage can cause optic dislocation of the IOL.

Petrelli et al.¹² have proposed the use of transscleral plugs Carlevale lens combined with PK for the management of post-traumatic aphakia with severe corneal scarring due to graft rejection in a non-vitrectomized eye. Conversely, in our paper, we report a relatively long-term follow-up adding further evidence regarding the good outcomes of this combined procedure also in eyes previously undergone PPV.

In conclusion, we report the feasibility of secondary IOL implantation using Carlevale with penetrating keratoplasty. The relative ease of Carlevale lens implantation through the transscleral plugs reduces the open globe length resulting in a safer procedure, especially for vitrectomized eyes.

Further studies with a larger sample and longer follow-ups are needed to corroborate these results.

Declaration of conflicting interests

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Supplemental material

Supplemental material for this article is available online.

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