Case Report

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Phakic anterior chamber intraocular lens removal with simultaneous posterior chamber phakic intraocular lens implantation and Descemet membrane endothelial keratoplasty

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Abstract:

The purpose of this study was to describe a case and clinical course of simultaneous anterior chamber phakic intraocular lens (AC-pIOL) removal, implantation of a posterior chamber phakic intraocular implantable collamer lens (ICL), and Descemet membrane endothelial keratoplasty (DMEK). This was a case report of a 44-year-old male with a unilateral decompensated cornea from a displaced Duet–Kelman lens on his left eye that underwent pIOL extraction and implantation of a posterior chamber phakic intraocular ICL and simultaneous DMEK. After 6 months, the cornea of the left eye had regained clarity, the Descemet membrane was graft stable, and the ICL implanted was centered with good vault. Postoperative anisometropia was avoided. There was no development of cataracts or other complications. The simultaneous pIOL extraction, ICL implantation, and DMEK in our case showed good results with full restoration of anterior segment anatomy and return of transparency of the cornea. The current case shows the feasibility of the simultaneous approach instead of sequential as an alternative for patients with endothelial disease associated with AC pIOLs, restoring vision and anatomy and also avoiding postoperative anisometropia.

Keywords:

Anterior chamber lens, Descemet membrane endothelial keratoplasty, Duet–Kelman, endothelial keratoplasty, explantation, high myopia, Implantable Collamer Lens, simultaneous

Introduction

Phakic intraocular lenses (pIOLs) have provided treatment options for patients with moderate-to-high myopia or hyperopia and also for patients found to have corneas inadequate for any form of corneal laser refractive surgery.[1,2] Angle-supported anterior chamber pIOLs (AC-pIOLs) were once a common design and option for the management of these high refractive errors. Currently, they are not in use since their withdrawal from the market because of their association with long-term iris and corneal complications, mainly in the form of endothelial damage leading to irreversible corneal edema in some cases.[3] Endothelial cell density (ECD) loss was greater than what is expected with aging, leading to a need for explantation in many cases.[4]

Lamellar techniques like Descemet membrane endothelial keratoplasty (DMEK) have gained popularity for the management of endothelial disorders such as Fuchs' dystrophy and pseudophakic bullous keratopathy. This is due to its excellent, visual, refractive, and clinical outcomes as well as less incidence of immunologic

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rejection compared to full-thickness corneal grafts.[5-7] For endothelial failure caused by pIOLs, a DMEK may also be an option as shown by a case report[8] which showed successes of a two-step technique of bilensectomy following DMEK.

When cataracts are present, AC-pIOLs can be removed without excessive impact on refraction and visual acuity due to the possibility of implantation of a pseudophakic posterior chamber IOL (PCIOL) following bilensectomy, i.e., pIOL extraction and phacoemulsification of the crystalline lens. However, if explantation is deemed necessary in a young patient (<50 years of age) with a clear lens, phacoemulsification is contraindicated due to the increased risk of retinal detachment[9] as well as the preservation of residual accommodation in this age group. On the other hand, the isolated explantation of the AC-pIOLs without new IOL implantation would leave the patient with limiting anisometropia and full contact lens dependency. Thus, a possible option for this group is a replacement by a posterior chamber pIOL (PC-pIOL) like a collamer-based pIOL (Implantable Collamer Lens [ICL]; STAAR). In a previous paper,[10] we reported for the first time the feasibility of AC-pIOL removal combined with ICL implantation to avoid limiting anisometropia, followed by a successful DMEK surgery (as a second step procedure) due to preoperative irreversible corneal edema. The aforementioned article was the first to suggest not only the feasibility of doing DMEK in a phakic patient with a PC-pIOL in place but to also show that filling the AC with gas during the procedure did not have any negative impact on the transparency of neither the PC-pIOL nor the crystalline lens, when in fact, the latter of the two actually gained protection intraoperatively from the pIOL from any potential iatrogenesis.

Hereafter, we present for the first time, to the best of our knowledge, a case of AC-pIOL-related corneal decompensation treated with simultaneous AC-pIOL removal, ICL/PC-pIOL implantation, and DMEK surgery. The patient gave verbal and written consent to use the resultant clinical data for scientific purposes.

Case Report

We present a 44-year-old male with pathologic myopia, postbilateral implantation of Duet–Kelman AC-pIOLs, and postbilateral laser-assisted *in situ* keratomileusis (LASIK) retouch for residual astigmatism. There already had been detected decreasing endothelial cell count 12 years prior, but despite annual review and advice for the need of AC-pIOL removal, the patient was lost to follow-up. He finally presented in our clinic referring to 2 months of progressive blurring of vision in his left eye with occasional pain. On the day of consultation, the cornea of the left eye had severe stromal edema and inferior bullous keratopathy [Figure 1a-b]. In the AC, the Kelman AC-pIOL was displaced temporally due to a dislocation of the superior haptic toward the posterior chamber through an iridectomy at the 1 o'clock position. The crystalline lens appeared unaffected and healthy [Figures 1a-b and 2a]. The posterior pole of the left eye could not be visualized due to the opaque media. A secondary LASIK flap fluid interface syndrome was also seen by optical coherence tomography [Figure 2a]. With specular microscopy, the ECD of the left eye was found to be low (593 cells/mm^2). The right eye was unremarkable, presenting a clear cornea, centered and stable Kelman pIOL, and healthy ECD by specular microscopy (2252 cells/mm^2). Uncorrected distance visual acuity (UDVA) of the left eye was 0.1 (decimal) and the corrected distance VA (CDVA) was 0.15 with a refraction of +2.00/−2.00 × 170° axis. The right eye had a CDVA of 1.00 with refraction of +0.50/−2.00 × 30° axis.Initially, the proposed surgical plan involved the extraction of the Kelman AC-pIOL combined with DMEK, followed by implantation of a toric ICL once refractive stability had been achieved to maximize the options of achieving emmetropia. Due to patient preference in relation to conflicting schedules and availability, the correction of the estimated refractive error with an ICL was finally decided to be done simultaneously with the pIOL extraction and DMEK.

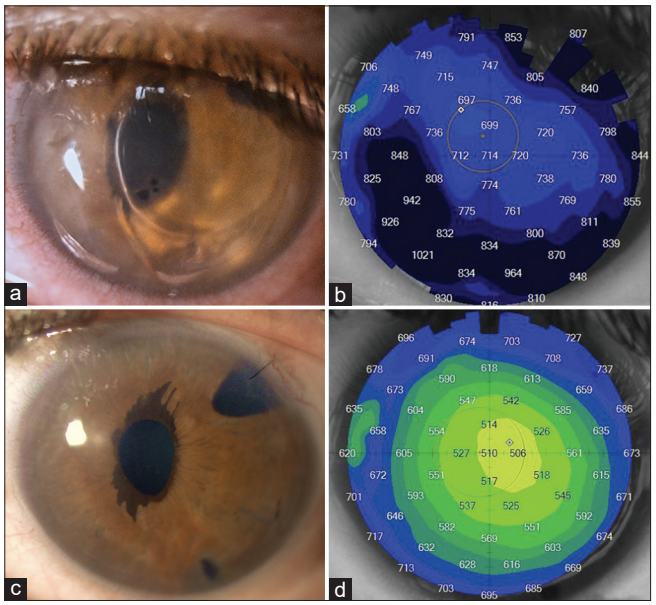

Figure 1: Gross Examination and pachymetry of the left eye. (a) Preoperative slit-lamp examination shows a hazy cornea due to severe stromal edema with inferior bullous keratopathy. The superior haptic of the Kelman anterior chamber phakic intraocular lens had dislocated through the 1 o'clock iridectomy causing temporal displacement of the whole lens. There were no signs of a developing cataract. (b) Preoperative pachymetry showing a diffusely thickened cornea. (c) Postoperative slit-lamp examination at 6 months shows full corneal transparency. There were no signs of implantable collamer lens displacement. Both superior and inferior iridectomies were patent. (d) Postoperative pachymetry at 6 months shows normal corneal thickness due to resolution of corneal edema

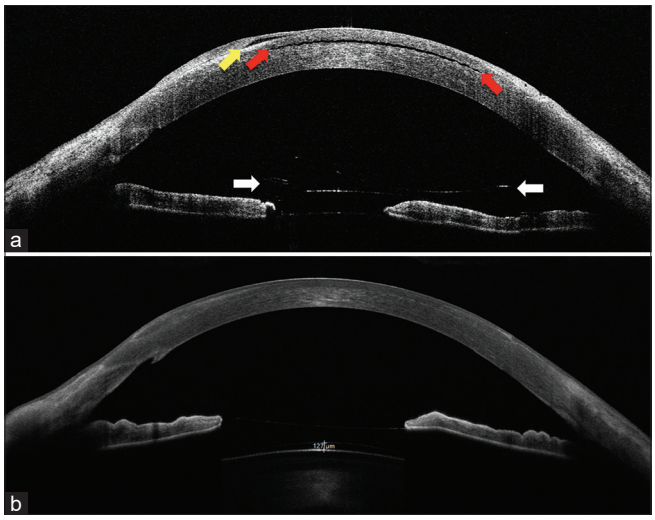

Figure 2: Anterior segment optical coherence tomography (AS-OCT) of the left eye (MS-39; CSO). (a) Preoperative AS-OCT shows a thickened cornea with inferior bullous keratopathy (yellow arrow), a secondary laser-assisted *in situ* keratomileusis (LASIK) flap fluid interface where there is fluid retention underneath the LASIK flap (red arrows) and the anterior chamber phakic intraocular lens displaced temporally (white arrows) (b) Postoperative AS-OCT shows improved corneal state with no edema. There are no signs of any detachment of the Descemet membrane endothelial keratoplasty or signs of rejection. The Implantable Collamer Lens is also stable with an adequate vault measuring 127 um

The patient was advised about the risk of less precision with the IOL power calculation and potential residual ametropia. Calculation (using the manufacturers' nomogram) was based on the preoperative ametropia from a decade before (−15.5D) as well as his last reliable residual refraction before his corneal disease had developed. Toricity on the IOL was avoided due to the impossibility of controlling the correct axis alignment during DMEK tapping maneuvers. The power of the ICL finally used had a spherical target of +0.5 D to attempt to balance out a target residual cylinder of −1.00D to attain a final spherical equivalent as close to zero as possible. This would be achieved by the use of paired incisions at the steep refractive axis.

An 8.5 mm DMEK graft was prepared during the procedure. Under peribulbar anesthesia, and without intracameral miotics or mydriatics, the Kelman AC-pIOL was disassembled (optic from the angle-supported haptics) and then was extracted through a 3.2 mm temporal limbal incision. An inferior peripheral iridectomy was then performed with an AC vitrector. The ICL was then implanted through the same incision using the mid-dilated pupil induced by peribulbar anesthesia injection and without any intracameral mydriatic agents to avoid interfering with the miosis needed during the DMEK procedure. ICL was positioned well in the sulcus. The surgeon then proceeded with a central 8.5 mm descemetorhexis under the cohesive viscoelastic AC fill. Bimanual viscoelastic extraction was then done, and intracameral miotic agents were added to achieve a well-constricted pupil that prevents IOL luxation during the tapping techniques. The previously harvested DMEK graft from the donor cornea (on-site surgeon preparation using the SCUBA technique and stained with membrane blue dye) was then inserted through the main incision with a Geuder DMEK injector (Geuder, Germany). Unfolding of the graft proceeded and finally fixation of the graft with 20% SF6 in the AC. The patient was given topical antibiotics for 7 days and topical steroids tapered over the next month.

In the postoperative period and during a 6-month observation period, the cornea remained clear with some residual but peripheral haze while the DMEK graft was stable. There were no signs of rejection [Figures 1c-d and 2b]. The ECD of the left eye at the 6-month mark was 2545 cells/mm^2. The ICL was also in place with an adequate vault measuring 127 um [Figure 2b]. The patient's UDVA was 0.4 with a subjective refraction of plano −1.25 cyl × 175° axis and a CDVA of 0.5. IOP was normal at 13 mmHg. The rest of the physical examination was normal.

Discussion

Patients who have undergone AC-pIOL implantation may develop long-term ECD loss, potentially leading to corneal decompensation and the need for corneal transplantation.[3] The mainstay of treatment in these cases is the removal of the instigating factor of decompensation, the pIOL. When the ECD loss from the original angle-fixated AC-pIOL has crossed the point of corneal decompensation, DMEK surgery may also be required to restore corneal transparency.

In addition, performing phacoemulsification and in-the-bag IOL implantation is possible in patients with coexisting cataracts. Contrastingly, bilensectomy is contraindicated in young patients with clear lenses due to the unjustified risk of complications, of which retinal detachment is the most concerning.[9] A possible option for refractive restoration in such patients is iris-fixated pIOLs, but in turn, they may cause additional endothelial damage.[11] A safe, endothelium-sparing alternative is ICL PC-pIOLs. However, the possible interactions between ICLs and DMEK surgery, both in terms of graft adherence and pIOL/crystalline lens transparency, are not fully clear yet.

We previously contributed our experience on this matter with the first description of a DMEK procedure in an eye that had undergone AC-pIOL explantation and ICL pIOL implantation.[10] Graft adhesion was not impaired; we observed a mild vault reduction probably due to a transitory anteroposterior push on the ICL by the gas bubble. Notwithstanding the slight hydrophilicity of

collamer, a porcine collagen/HEMA polymer, no effect was noted on ICL (nor crystalline lens) transparency.

Indeed, cataract formation and IOL opacification are acknowledged risks of DMEK surgery.[12,13] We hypothesized that interposing a collamer-made pIOL between the AC and PC may protect the lens or a hydrophilic pseudophakic IOL from intraoperative mechanical damage or opacification due to contact with the gas/air bubble.

In the present case report, favorable outcomes in terms of crystalline lens and ICL transparency are confirmed for a second time, sustaining our initial hypothesis. Besides, graft distension and adhesion were not impaired. Notably, this specific case presented some difficulties. A Kelman haptic had to be removed carefully due to displacement through the iridectomy. Furthermore, as per the patient's request, ICL power calculations had to be based on refractive status before and after the primary AC lens implantation, and taking into consideration previous excimer laser surgery, adding uncertainty to the estimations of refractive result. Furthermore, Kelman lens explantation, ICL implantation, and DMEK were performed by virtue of the patient's request during a combined single procedure. To the best of our knowledge, this is the first description of such an approach. Despite the specificities of this case, the final outcomes were satisfactory, allowing the patient to regain corneal transparency while conserving lens transparency, maintaining a plenty acceptable refractive status, preserving accommodation, and avoiding a second surgical procedure.

Conclusion

This case report confirms our previous observations on the feasibility and excellent outcomes of DMEK after collamer-based PC-IOL implantation. ICLs may also play a protective effect against opacification of the crystalline lens or pseudophakic hydrophilic IOLs. Furthermore, we demonstrated that DMEK can be performed following AC-pIOL explantation and ICL implantation during one surgical procedure, sparing selected patients the need for a reintervention. Further studies are needed to confirm these findings in larger sample sizes.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

The authors declare that there are no conflicts of interests of this paper.

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