Quadruple Procedure for Visual Rehabilitation of Endothelial Decompensation Following Phakic Intraocular Lens Implantation

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• PURPOSE: **To evaluate the clinical outcomes of combined phakic intraocular lens (phakic IOL) explantation, phacoemulsification, posterior chamber intraocular lens (PCIOL) implantation, and Descemet stripping automated endothelial keratoplasty (DSAEK) performed for phakic IOL–related endothelial decompensation.**

• DESIGN: **Retrospective, interventional case series.**

• METHODS: SETTING: **Private hospital.** STUDY POPULATION: **Ten eyes of 7 patients who developed endothelial decompensation after phakic IOL implantation and were treated with a combined procedure of phakic IOL explantation, phacoemulsification, PCIOL implantation, and DSAEK.** MAIN OUTCOME MEASURES: **Best spectacle-corrected visual acuity (BSCVA), manifest refractive error, endothelial cell count, and intraoperative and postoperative complications.**

• RESULTS: **Mean postoperative follow-up was 25.2 ± 28.6 months (range 3–84 months). BSCVA at last visit was 7/10 or better in 6 eyes, 4/10 in 1 eye, and 2/10 or worse in 3 eyes, of which all had myopic maculopathy or deep amblyopia. Mean postoperative spherical equivalent was −3.4 ± 1.2 diopters. Mean endothelial cell loss in comparison to preoperative donor endothelial cell density was 21.3% ± 7.7%. Minor PCIOL decentration was seen in 1 patient, and IOL exchange was required in another patient owing to high postoperative refractive error. One graft rejection leading to graft failure was seen and was excluded from endothelial cell loss calculation.**

• CONCLUSION: **An operation combining phakic IOL removal, DSAEK, cataract removal, and PCIOL implantation can offer fast visual rehabilitation with good visual results and graft survival.** **(Am J Ophthalmol 2014;158:1330–1334. © 2014 by Elsevier Inc. All rights reserved.)**

SEVERAL STUDIES HAVE SHOWN THAT ENDOTHELIAL cell loss may progress abnormally after implantation of phakic intraocular lenses (phakic IOLs), possibly resulting in corneal decompensation and bullous keratopathy.[1–6] Endothelial failure has been reported as early as 2 years and as late as 14 years after surgery.[3–5] Proposed mechanisms for this complication include trauma during implantation and/or postoperative intermittent contact between phakic IOL and endothelium because of poor phakic IOL fixation, improper phakic IOL sizing, and/or eye rubbing.[1,4,6]

Accelerated endothelial cell loss following phakic IOL implantation can be treated with phakic IOL explantation or bilensectomy (ie, removal of phakic IOL and of the crystalline lens), but the simultaneous presence of frank endothelial decompensation also requires replacement of the dysfunctional corneal endothelium. In addition, endothelial keratoplasty alone in the presence of a phakic IOL may be difficult to perform, and both donor endothelium and the patient's crystalline lens could be damaged during graft delivery and placement, as well as during air filling at the end of the procedure.

Previous reports have described the management of phakic IOL–induced corneal edema by means of penetrating keratoplasty combined with bilensectomy and intraocular lens implantation.[2,6–8] These patients can now be treated by means of phakic IOL explantation and endothelial keratoplasty, with or without cataract removal and posterior chamber intraocular lens (PCIOL) implantation, allowing a much safer surgery performed under "closed system" conditions with more predictable and stable postoperative refractive results, as well as faster visual rehabilitation.

Our study describes the results of a quadruple procedure performed in eyes with endothelial failure following phakic IOL implantation, combining phakic IOL explantation, phacoemulsification, posterior chamber intraocular lens implantation, and Descemet stripping automated endothelial keratoplasty (DSAEK).

METHODS

THE ANALYSIS OF THIS RETROSPECTIVE INTERVENTIONAL case series followed the tenets of the 1964 Declaration of Helsinki and Italian law. The study was approved by the Institutional Review Board of "Villa Igea" Hospital. We reviewed the records of all patients with endothelial

AJO.com Supplemental Material available at AJO.com.
Accepted for publication Sep 1, 2014.

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0002-9394/$36.00
http://dx.doi.org/10.1016/j.ajo.2014.09.002

decompensation following phakic IOL implantation who underwent surgery, according to the technique described in detail below, at our institution ("Villa Serena-Villa Igea" Private Hospitals in Forlì, Italy) between November 1, 2006 and April 2, 2014 by the same surgeon (M.B).

Preoperatively, all patients underwent a complete ophthalmologic examination, including slit-lamp biomicroscopy, best spectacle-corrected visual acuity (BSCVA), applanation tonometry, and funduscopy or B-scan of the posterior segment (when necessary). Visual acuity was measured by means of Snellen charts in all patients. Baseline donor endothelial cell density was measured by the provider eye bank by means of specular microscopy.

The power of the intraocular lens to be implanted was calculated by means of partial coherence interferometry (Lenstar LS 900; Haag-Streit AG, Koeniz, Switzerland), using the SRK-T formula for pseudophakic patients with polymethyl methacrylate lens.[9] Target refraction was −1.50 to −2.5 diopters (D) according to the refraction obtained from the fellow eye and a presumed hyperopic shift of 0.75 D induced by DSAEK.[10]

All eyes were evaluated at the first postoperative day; at the first, third, sixth, and twelfth month postoperatively; and yearly thereafter.

Outcome measures included BSCVA, manifest refraction, endothelial cell count, and intraoperative and postoperative complications.

• **SURGICAL TECHNIQUE:** Patients were sedated with intravenous droperidol, 3 mL (7.5 mg), immediately before anesthesia was obtained with peribulbar injection of 5 cc of 2% lidocaine hydrochloride and 5 cc of 0.5% bupivacaine hydrochloride. Epithelial debridement was performed using a dry cellulose sponge. Side entries were performed at the 3 and 12 o'clock positions and an anterior chamber maintainer was inserted superiorly. A 5–6 mm limbal incision was performed at the 9 o'clock position to allow IOL removal. Different maneuvers were necessary for different types of phakic IOLs, but were all performed under continuous flow of balanced salt solution (BSS) from the anterior chamber maintainer, similarly to what has been done in the past by many surgeons performing various types of cataract surgery.[11] Also, as the endothelium was to be removed anyway, thus needing no protection, no viscoelastic substance was used throughout the procedure to prevent its presence in the interface possibly causing visually significant opacities.[12] The Fyodorov posterior chamber phakic IOLs were moved first into the anterior chamber; then the silicone plates were cut as needed and the different pieces were explanted separately; also the haptics of angle-fixated phakic IOLs were cut from the optic part prior to removal. Instead, iris-fixated IOLs were first disenclavated and then removed in 1 piece. The limbal incision was sutured temporarily using interrupted 10-0 nylon stitches.

Capsulorrhexis was performed using a 27 gauge (G) bent needle through the 12 o'clock side entry. Bimanual phacoemulsification or lens aspiration was performed in a standard fashion through the limbal incision, partially opened to a 3.2 mm size by partial suture removal or through the 12 o'clock incision enlarged to 3.2 mm. All sutures of the limbal incision were removed and the intraocular lens was implanted into the capsular bag under continuous BSS flow from the anterior chamber maintainer. No viscoelastic devices were used so as to not encumber later endothelial graft adhesion.

The patient's Descemet membrane was stripped and removed, and a DSAEK or ultrathin DSAEK graft was prepared and delivered through the limbal incision according to the technique previously described.[13,14] All incisions, including the side entries, were sealed air-tight with interrupted 10-0 nylon stitches. Postoperatively, patients were given topical antibiotics and steroids tapered down in a regimen previously described by our group.[14] All sutures were removed from all patients between 4 and 6 weeks after surgery.

A Supplemental Video (available at AJO.com) illustrates the surgery steps.

RESULTS

TEN CONSECUTIVE EYES OF 7 PATIENTS THAT UNDERWENT the quadruple procedure are included in this series. Demographic and clinical data of all cases are summarized in the Table.

Of the 10 eyes in this series, none had had preoperative cataractous changes. Mean postoperative follow-up was 25.2 ± 28.6 months (range 3–84 months). BSCVA at last visit was 7/10 or better in 6 eyes, 4/10 in 1 eye, and 2/10 or worse in 3 eyes, of which all had myopic maculopathy or deep amblyopia.

Mean spherical equivalent was −3.4 ± 1.2 D. Mean endothelial cell loss was 21.3% ± 7.7% when excluding Case 5, in which cell count was performed after a rejection episode that led to graft failure. Endothelial cell counts were obtained at different times postoperatively, as shown in the Table.

PCIOL decentration was caused in 1 patient (Case 4) by implantation of 1 haptic in the ciliary sulcus, but it was minor and did not require any treatment. PCIOL exchange was required in 1 patient (Case 6) for a −9 D postoperative refractive error supposedly resulting from grossly inaccurate axial length measurement done in a staphylomatous eye. In 1 eye, graft rejection leading to graft failure was seen 3 months postoperatively (Case 5). Recurrent DSAEK was performed in this case and BSCVA was 10/10 at last follow-up.

The Figure demonstrates preoperative and 6-weeks-postoperative images of a patient with Fyodorov "collar button" posterior chamber phakic IOL who developed corneal decompensation 16 years after the initial surgery (Case 10).