Endothelial cell loss after phacoemulsification in eyes with previous penetrating keratoplasty, previous deep anterior lamellar keratoplasty, or no previous surgery

Banu Torun Acar, MD, Canan Asli Utine, MD, MSc, Suphi Acar, MD, Ferda Ciftci, MD

PURPOSE: To compare phacoemulsification-related endothelial cell loss in eyes with previous penetrating keratoplasty (PKP), previous deep anterior lamellar keratoplasty (DALK), or no previous corneal surgery.

SETTING: Ophthalmology Clinic, Haydarpasa Numune Education and Research Hospital, Istanbul, Turkey.

DESIGN: Comparative case series.

METHODS: Eyes with previous PKP (Group 1), previous DALK (Group 2), or no previous ocular surgery (Group 3) had extracapsular cataract extraction by phacoemulsification. The endothelial cell count was evaluated 1, 3, 6, and 12 months after cataract surgery.

RESULTS: Group 1 comprised 16 eyes and Group 2 and Group 3, 20 eyes each. The endothelial cell density (ECD) decreased progressively throughout the follow-up in all groups ($P<.01$). The amount of change in ECD was significantly greater in Group 1 than in Group 2 and Group 3 from preoperatively to 1 month postoperatively, from 1 to 3 months postoperatively, from 3 to 6 months postoperatively, and from 6 to 12 months postoperatively (all $P<.01$). The changes were similar in Group 2 and Group 3 at all time points ($P>.05$).

CONCLUSIONS: Eyes with previous PKP had significantly greater endothelial cell loss than eyes with previous DALK or no previous surgery. Preservation of the patient's endothelium seems to be an advantage of DALK in terms of increasing corneal safety in future intraocular surgery.

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In eyes with previous penetrating keratoplasty (PKP), cataract surgery by the phacoemulsification technique may cause significant endothelial injury and affect long-term graft survival.[1,2] Thus, the use of a combined triple procedure of cataract extraction, intraocular lens (IOL) implantation, and PKP rather than sequential corneal and cataract surgeries in these eyes has been debated.[3] Similarly, simultaneous deep anterior lamellar keratoplasty (DALK) and phacoemulsification has been recommended for eyes with coexisting corneal stromal pathologies and cataract when the recipient endothelium is viable.[4] However, in eyes with no preexisting lenticular changes, the need for cataract surgery may emerge later.

To our knowledge, there are no previous studies comparing endothelial cell loss after cataract surgery in eyes with previous PKP or DALK. In this study, we compared the endothelial cell count (ECC) in eyes with previous PKP, previous DALK, or no previous corneal surgery during the first year after phacoemulsification.

PATIENTS AND METHODS

This prospective nonrandomized parallel-group comparative case series comprised eyes that had PKP between May 2007 and June 2009 (Group 1), eyes that had DALK between December 2007 and July 2009 (Group 2), and eyes with no previous ocular surgery (Group 3). All patients had extracapsular cataract extraction (ECCE) phacoemulsification between August 2009 and December 2010. All corneal and cataract surgeries were performed at Haydarpasa Numune Education and Research Hospital, Ophthalmology Clinic,

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Istanbul, Turkey. Patients were followed regularly during the first postoperative year and were evaluated with respect to endothelial cell count and density. This study adhered to the Declaration of Helsinki, and written informed consent was obtained from all patients preoperatively and before each postoperative examination.

The inclusion criteria in all groups were age from 46 to 68 years, a minimum endothelial cell density (ECD) before cataract surgery of 1980 cells/mm^2, and no clinically detectable endothelial decompensation. The cataracts were graded using the Lens Opacities Classification System III[5] by the same examiner after slitlamp examination to ensure all patients in the study had a similar degree of nuclear opacification.

Surgical Technique

Penetrating Keratoplasty Penetrating keratoplasty was performed using regional anesthesia. Donor corneas were punched out from the endothelial side with a Barron donor punch (Katena Products, Inc.) with a diameter 0.5 mm larger than that of the recipient. The recipient cornea was trephined using a Hessburg-Barron vacuum trephine with a 7.0 or 7.5 mm diameter (Katena Products, Inc.). Removal of the cornea was completed with curved corneal scissors. After the donor cornea was secured with 4 interrupted 10-0 nylon sutures, 16 single running sutures were added. At the conclusion of surgery, corneal astigmatism was adjusted by replacing tight or loose sutures.

Deep Anterior Lamellar Keratoplasty Deep anterior lamellar keratoplasty was performed using regional anesthesia and the big-bubble technique described by Anwar and Teichmann.[6] A Hessburg-Barron suction trephine (JedMed Instrument Co.) (7.0 mm or 7.5 mm) was used for partial-thickness trephination of the host cornea up to 60% to 80% depth. After remnants of posterior stromal lamellae were removed and a fully transparent Descemet membrane was achieved, the donor tissue was prepared. The donor cornea was cut from the endothelial side with a Barron donor punch 0.5 mm larger than the recipient cornea. The endothelium was scrapped completely from the button. The donor cornea was placed on the recipient bed and sutured using 10-0 monofilament nylon (4 sutures). Then, the graft was fixed with 16-bite single running sutures.

Cataract Surgery Cataract surgery was performed by the same surgeon (S.A.) using topical anesthesia and the same technique in all 3 groups at least 12 months after PKP or DALK in Group 1 and Group 2, respectively. The surgery was started with a 3.0 mm clear corneal incision and instillation of a dispersive ophthalmic viscosurgical device (OVD) (sodium hyaluronate 3.0%–chondroitin sulfate 4.0% [Viscoat]) and then a cohesive OVD (sodium hyaluronate 1.0% [Provisc]) into the anterior chamber. A continuous curvilinear capsulorhexis (CCC) was created using a bent needle; the CCC was approximately 5.5 mm in diameter. After hydrodissection, endocapsular phacoemulsification of the nucleus and aspiration of the residual cortex were performed with fortified balanced salt solution (BSS Plus). The lens capsule was inflated with a cohesive OVD, after which the IOL was placed in the capsular bag and the OVD thoroughly evacuated. A subconjunctival injection of dexamethasone 4 mg and gentamicin 20 mg was given at the end of each surgery.

Postoperative management included topical corticosteroid agents, antibiotic agents, and surface lubricants. In Group 1, prednisolone acetate (Pred Forte) was used 1 drop every hour and then tapered to 6 times a day in the subsequent 2 weeks and 4 times a day in the fourth week. In Group 2 and Group 3, prednisolone acetate was used 6 times a day in the first 2 weeks postoperatively and 4 times a day in week 3 and week 4. Topical ofloxacin 0.3% (Exocin) was used 6 times a day in the first 2 weeks postoperatively in all 3 groups.

Endothelial Cell Analysis

Corneal endothelial cell analysis was performed with a noncontact specular microscope (EM-2000, Tomey) preoperatively (within 1 week) and postoperatively at 1, 3, 6, and 12 months. In each analysis, the ECC was obtained by the same technician using the variable-frame analysis method, in which the borders of the largest possible known area of cells are outlined, preferably incorporating a minimum of 100 contiguous cells. The cells in this area are counted and the number of cells within the given area is used to calculate the ECD.

Statistical Analysis

Statistical analysis was performed using the SPSS software (version 15.0, SPSS, Inc.). The normality of the distribution of each parameter was checked using the Kolmogorov-Smirnov test. One-way analysis of variance (ANOVA) was used to compare the mean age and the ECD at each time point in the 3 groups. If a significant difference between the 3 groups was found, the Tukey honestly significant difference test was used as a post hoc comparison of the groups by pairs. One-way repeated measures ANOVA was calculated to compare the ECD at 5 time points (ie, preoperative and 1, 3, 6, and 12 months postoperative) in Groups 1, 2, and 3. If a significant effect was found, follow-up protected t tests were performed to compare the ECD at subsequent time points. A P value less than 0.05 was considered statistically significant.

RESULTS

Group 1 (previous PKP) comprised 16 eyes of 16 patients (10 men, 6 women). Group 2 (previous DALK) comprised 20 eyes of 20 patients (12 men, 8 women). Group 3 comprised 20 eyes of 20 patients (10 men, 10 women). The mean age of the patients at the time of cataract surgery was 54.63 years ± 5.84 (SD) (range 46 to 68 years) in Group 1, 56.00 ± 6.25 years

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From the Ophthalmology Clinic, Haydarpasa Numune Education and Research Hospital (B.T. Acar, S. Acar), and the Department of Ophthalmology, Yeditepe University (Utine, Ciftci), Istanbul, Turkey.

Corresponding author: Canan Asli Utine, MD, MSc, Yeditepe University Eye Hospital, Gazi Umur Pasa Sok, No: 28, Besiktas Balmumcu, 34345 Istanbul, Turkey. E-mail: cananutine@gmail.com.