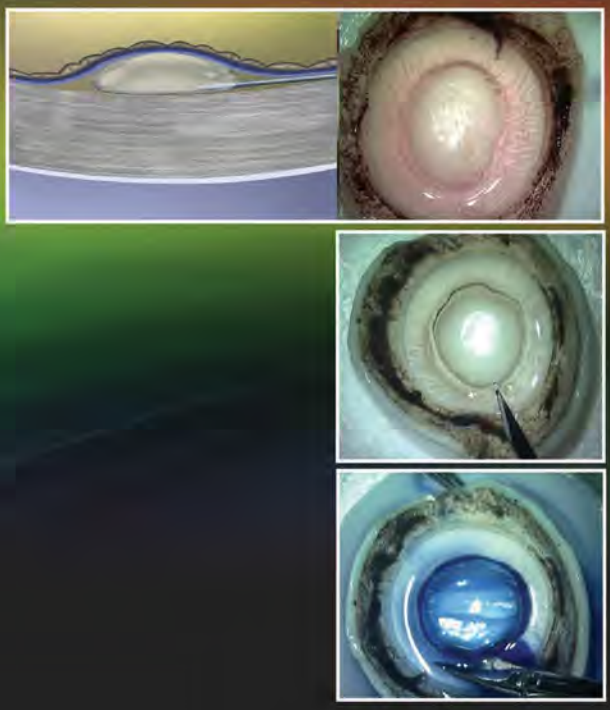
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Pre-Descemet's Endothelial Keratoplasty (PDEK)



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Contents

SECTION I: BASICS

1. **Corneal Anatomy and Ultrastructure** 3
Dhivya Ashok Kumar, Amar Agarwal
- Corneal Histology *3*
- Isolation of Pre-Descemet's Layer *6*
- Corneal Layers and their Applied Anatomy *7*

2. **Preoperative Assessment, Indications and Contraindications in Endothelial Keratoplasty** 12
Dhivya Ashok Kumar, Amar Agarwal
- Indications *12*
- Contraindications *13*
- Preoperative Assessment *13*

3. **Classification of Descemet's Membrane Detachment** 22
Soosan Jacob, Amar Agarwal
- Descemet's Membrane Detachment *22*
- New Classification of Descemet's Membrane Detachment *22*
- Anterior Segment Optical Coherence Tomography Features *25*
- Relaxing Descemetotomy *26*
- Treatment for Descemet's Membrane Detachment Based on Classification *26*

4. **Keratoplasty Techniques for Corneal Endothelial Disease: A Comparison of Procedures** 31
Rahul Tonk, Carolina Mercado, Ibrahim Osama, Carol L Karp
- Introduction and Historical Background *31*
- Penetrating Keratoplasty *32*
- Descemet's Stripping Endothelial Keratoplasty *33*
- Descemet's Membrane Endothelial Keratoplasty *36*
- Pre-Descemet's Endothelial Keratoplasty *39*

5. **Pre-Descemet's Endothelial Keratoplasty: Principles and Types of Big Bubbles** 45
Ashvin Agarwal, Priya Narang, Dhivya Ashok Kumar, Amar Agarwal
- Background *45*
- Pneumatic Dissection and Big Bubble Creation *45*
- PDEK Surgical Technique *48*
- Postoperative Management *52*
- PDEK versus Other EK *53*
- PDEK and Young Donor *54*
- Donor Age and Endothelial Keratoplasty *55*

SECTION II: SURGICAL TECHNIQUE

6. **Surgical Technique of Pre-Descemet's Endothelial Keratoplasty: 15 Steps to Mastering PDEK** 59
Priya Narang, Amar Agarwal
- Donor Graft Preparation *59*
- Recipient Bed Preparation and Graft Insertion *60*
- Discussion *68*

7. **Air Pump-assisted Pre-Descemet's Endothelial Keratoplasty** 70
Soosan Jacob, Amar Agarwal
- Technique *70*
- Advantages of Pre-Descemet's Endothelial Keratoplasty *71*
- Disadvantages of Pre-Descemet's Endothelial Keratoplasty *71*
- Advantages of Air Pump-assisted Pre-Descemet's Endothelial Keratoplasty *72*
- Tips and Tricks *73*

8. **Trocar Anterior Chamber Maintainer** 77
Amar Agarwal, Priya Narang
- Background *77*
- The New Trocar Anterior Chamber Maintainer *77*
- Surgical Technique using TACM *78*
- Advantages of TACM *81*
- TACM in Anterior Segment Surgery *81*

9. **Endoilluminator-assisted Pre-Descemet's Endothelial Keratoplasty** 84
Soosan Jacob, Amar Agarwal
- Technique *84*
- Advantages of Endoilluminator-assisted PDEK *85*

10. Infant and Young Donor Pre-Descemet's Endothelial Keratoplasty 88
Priya Narang, Amar Agarwal
- Descemet's Membrane Endothelial Keratoplasty and Young Donor *88*
- Pre-Descemet's Endothelial Keratoplasty Bubble Creation and Young Donor *88*
- Discussion *89*

SECTION III: SPECIAL SITUATIONS

11. Glued Intraocular Lens 95
Athiya Agarwal, Amar Agarwal
- White-to-White Measurement *95*
- Conjunctival Peritomy *96*
- Scleral Marking *96*
- Scleral Flap Preparation *96*
- Infusion with a Trocar Cannula *99*
- Infusion with an Anterior Chamber Maintainer *100*
- Trocar Cannula versus Anterior Chamber Maintainer *100*
- Sclerotomies under the Flap *101*
- Vitrectomy *101*
- Intraocular Lens Types *102*
- Foldable Intraocular Lens Injectors *104*
- Leading Haptic Externalization *104*
- Trailing Haptic Externalization *104*
- Vitrectomy around the Sclerotomy *105*
- Scharioth Scleral Pocket and Intrascleral Haptic Tuck *108*
- Air in the Anterior Chamber *110*
- Fibrin Glue *110*
- Postoperative Regimen *111*
- Stability of the Intraocular Lens Haptic *111*
- Advantages *113*
- Surgical Steps of Glued Intraocular Lens *115*

12. Single-Pass Four-Throw Technique for Pupilloplasty 119
Priya Narang, Amar Agarwal
- Connection to PDEK or EK *119*
- Single-Pass Four-Throw Pupilloplasty *120*
- Technique *122*
- Endoilluminator *124*
- Trocar Anterior Chamber Maintainer *124*
- Discussion *126*
- Advantages of SFT over Other Techniques *126*

13. **Pre-Descemet's Endothelial Keratoplasty with Glued Intraocular Lens** 127
Priya Narang, Amar Agarwal
- Glued Intraocular Lens with Endothelial Keratoplasty *127*
- Principles of Combining Glued IOL with PDEK *127*
- It Takes Two to Tango: Pre-Descemet's Endothelial Keratoplasty with Glued IOL *131*
- Technique *132*
- Advantages *133*
- Iphone-assisted High-Speed Photography for Glued IOL Understanding *135*

14. **Double Infusion Cannula Technique: Pre-Descemet's Endothelial Keratoplasty in Eyes without a Capsule** 138
Priya Narang, Amar Agarwal
- Double Infusion Cannula Technique *138*
- Surgical Technique *141*
- Discussion *142*

15. **Pre-Descemet's Endothelial Keratoplasty in Failed Keratoplasties** 144
Dhivya Ashok Kumar, Amar Agarwal
- PDEK on Failed Keratoplasty *144*
- Demographics and Observations *145*
- Visual and Clinical Outcomes *145*
- Complications *146*
- Pre-Descemet's Endothelial Keratoplasty in Failed Keratoplasty *146*

SECTION IV: COMPLICATIONS ND RESULTS

16. **Intraoperative Complications of Pre-Descemet's Endothelial Keratoplasty** 153
Dhivya Ashok Kumar, Amar Agarwal
- Background *153*
- Complications during Pneumatic Dissection *153*
- Graft-related Complications *157*
- Other Intraoperative Complications *160*

17. **Postoperative Complications of Pre-Descemet's Endothelial Keratoplasty** 164
Dhivya Ashok Kumar, Amar Agarwal
- Immediate Postoperative Complications *164*
- Late Postoperative Complications *170*

18. Mouse Sign for Inverted Pre-Descemet's Endothelial Keratoplasty Grafts 175
Dhivya Ashok Kumar, Amar Agarwal
- Background *175*
- Mouse Sign in Optical Coherence Tomography *175*
- Case Scenarios *175*
- Etiology for Mouse Configuration *177*
- Graft Adhesion *178*

19. Optical Coherence Tomography Analysis and Results in Pre-Descemet's Endothelial Keratoplasty 180
Dhivya Ashok Kumar, Amar Agarwal
- Anterior Segment Spectral Domain OCT Evaluation *180*
- Comparison of PDEK with the Other Endothelial Keratoplasties *186*
- Results in PDEK *186*

20. Conversion from Pre-Descemet's Endothelial Keratoplasty to Descemet's Membrane Endothelial Keratoplasty 190
Dhivya Ashok Kumar, Amar Agarwal
- Big Bubble *190*
- Indications *190*
- Etiology *190*
- Conversion of PDEK to DMEK *191*

SECTION V: MISCELLANEOUS

21. Scarred Cornea to Clear Cornea: Avoiding Penetrating Keratoplasty and Boston Keratoprosthesis 197
Priya Narang, Amar Agarwal
- Our Surgical Experience *198*
- Discussion *199*

22. Cosmetic Iris Implant Complications: Managed by Triple Procedure of Cataract, SPFT Pupilloplasty and PDEK 203
Priya Narang, Amar Agarwal
- Surgical Intervention *203*
- Discussion *211*

23. Optical Coherence Tomography Guided Pre-Descemet's Endothelial Keratoplasty 212
Soosan Jacob
- Optical Coherence Tomography-Guided DMEK and PDEK *212*
- Endoilluminator-assisted Descemet's Membrane Endothelial Keratoplasty *215*
- Other Techniques for Confirming Graft Orientation *215*

24. Eye Bank Preparation of Pre-Descemet's Endothelial Keratoplasty Grafts **218**
Elizabeth Shen, Adam Fox, Patrick Conrick, Sumit Garg
- Technique ***218***
- Endothelial Cell Loss ***220***

25. Pre-descemetocele **222**
Priya Narang, Amar Agarwal
- Optical Coherence Tomography ***222***
- Case Study ***222***
- Discussion ***223***

Index *227*

CHAPTER 2

Preoperative Assessment, Indications and Contraindications in Endothelial Keratoplasty

Dhivya Ashok Kumar, Amar Agarwal

INTRODUCTION

Endothelial keratoplasty (EK) has enormously overtaken the full thickness penetrating keratoplasty surgery in the last 2 decades without doubt.[1-6] It is known from the terminology as selective transplantation of the endothelium-Descemet's membrane complex with or without the posterior stroma. As compared to the whole corneal transplantation, it has its specific clinical advantages. Early visual recovery, less suture-related complications, and minimal postoperative complications have made EK widespread. Since the introduction of the posterior lamellar keratoplasty, various modifications have occurred in EK which includes Descemet's stripping endothelial keratoplasty (DSEK), Descemet's stripping automated endothelial keratoplasty (DSAEK), Descemet's membrane endothelial keratoplasty (DMEK), and recently pre-Descemet's endothelial keratoplasty (PDEK).[7-11] Even though EK is typically performed in eyes with the decompensated cornea as a result of abnormal endothelial function, patient selection is highly vital to acquire the best postoperative outcome. Thus, the current chapter has been solely dedicated for the preoperative examinations, indications, contraindications, and evaluations for an ideal patient selection for EK.

INDICATIONS

Endothelial keratoplasty is the treatment of choice for any patient with corneal endothelial dysfunction that has become visually disabling. The indications can be broadly classified into:

- *Primary or intrinsic endothelial disorders:*
  - Fuchs endothelial dystrophy
  - Posterior polymorphous corneal dystrophy
  - Congenital hereditary endothelial dystrophy
  - X-linked endothelial corneal dystrophy
  - Iridocorneal endothelial syndrome.
- *Secondary or acquired endothelial disorders:*
  - Postsurgical

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  - Cataract
    - Pseudophakic bullous keratopathy
    - Aphakic bullous keratopathy
    - Toxic anterior segment syndrome
    - Chronic Descemet's membrane detachment (after failed attempts of air injection).
  - Keratoplasty
    - Immunologic rejection
    - Endothelial decompensation in an existing graft.
  - Glaucoma
    - Postfiltration surgery (tube shunt)
    - Chronic topical medication toxicity
    - Congenital glaucoma.
- Trauma
  - Birth forceps injury
  - Blunt injury.

CONTRAINDICATIONS

Endothelial keratoplasty is contraindicated in conditions like keratoconus, corneal ectasia, stromal opacity or scarring (posttrauma/viral infection/interstitial keratitis), stromal (granular or lattice) or epithelial dystrophy, and borderline hypotony (results in poor clearing of graft).

PREOPERATIVE ASSESSMENT

Careful and elaborate preoperative assessment is mandatory to ensure that each patient will visually benefit from the surgery.

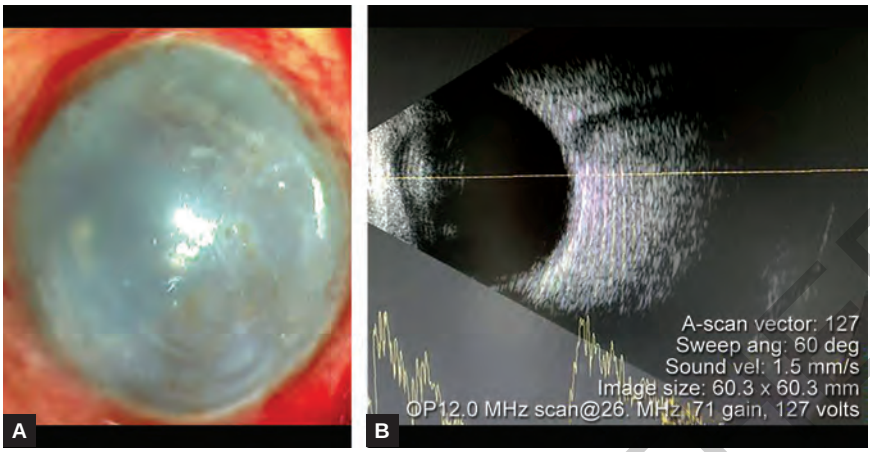
Clinical History

Preoperative clinical history is obtained from all the patients during their initial assessment and it is crucial in identifying any previous viral illness, dystrophic conditions, familial predisposition, and trauma. Previous surgical history, comorbidity treatment, and systemic ailments have to be documented. Patients on antiglaucoma medications or antiuveitis drugs should be obtained. Patient's history on antiglaucoma of an already failed keratoplasty, graft rejection, and dry eye has to be acquired because they will not only let us know the risk of complications but also in postoperative prognosis and management.

Assessment of Visual Potential of the Affected Eye

Visual potential assessment is the basic test for any preoperative corneal surgical workup. Snellen's distant acuity chart or Early Treatment Diabetic

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Figs. 2.1A and B: (A) Clinical picture of an eye with severe corneal edema hindering fundus examination; and (B) Ultrasound examination for evaluation of posterior segment.

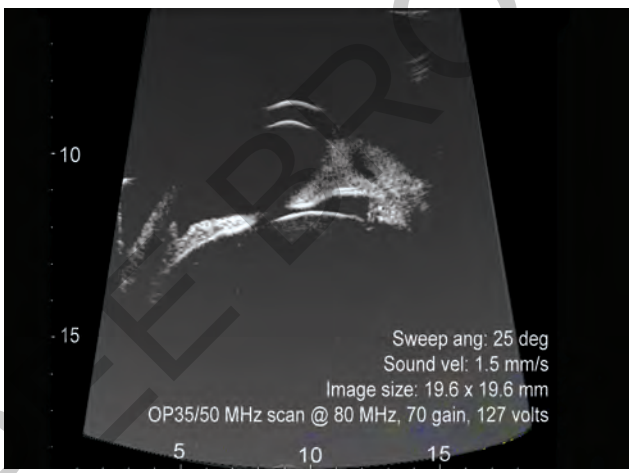


Fig. 2.2: Ultrasound biomicroscopy in an eye with iridocorneal endothelial syndrome showing peripheral anterior synechiae.

Retinopathy Study (ETDRS) chart for distance vision and times Roman or J-type near acuity charts for near vision by can be used. Visual acuity not correlating with the corneal opacity has to be confirmed by pinhole visual acuity, potential acuity meter, laser interferometry, or retinal acuity meter. In cases, where visualization of posterior segment is difficult because of corneal edema or scarring, patients should be tested for four-quadrant light projection; thus denoting bedside analysis of retinal and optic nerve function. Ancillary investigations such as B scan can be used for posterior segment (Figs. 2.1A and B) and ultrasound biomicroscopy (Fig. 2.2) for anterior

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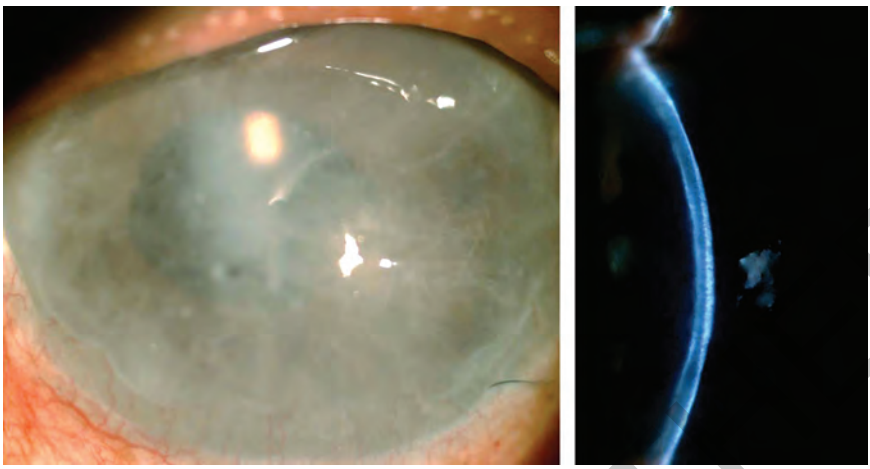


Fig. 2.3: Slit lamp examination of preoperative status of an eye with corneal endothelial decompensation.

segment in cases of hazy cornea. Optical coherence tomography of macula or optic nerve and electrophysiological studies may also be required to evaluate the visual potential of eye.

Slit Lamp Biomicroscopy

A careful slit lamp examination is required as a preliminary assessment for all eyes undergoing EK. Corneal opacity grade, corneal thickness, level of scar, nature of epithelium (presence of bullae, hypertrophy, microvesicles, edema), subepithelial scar, and epithelial defect have to be noted (Fig. 2.3). Staining can be done in specific cases if required. Anterior chamber (depth, inflammation if present), pupil reaction, and lens status (phakic or pseudophakic) should be observed and has to be noted in the case file. In pseudophakic eyes, one has to look for the centeration of intraocular lens (IOL), tilt, capsule defect, pseudophacodonesis, and synechiae. The IOL-related (Fig. 2.4) complications (malpositioned IOL, tilted IOL) and pupil damage had to be corrected in the same sitting or prior to EK procedure. Examination of the fellow eye has to be performed without fail in all eyes with unilateral involvement. It can give clues like early guttata, or other dystrophic changes. Thus, slit lamp examination has to be performed meticulously not only to evaluate the existing primary corneal pathology but also to identify the etiology.

Adnexa Examination

Attention should be paid to the regularity of lid margins, position of lids, adequacy of lid closure, and blink rate. Lid abnormalities such as trichiasis,

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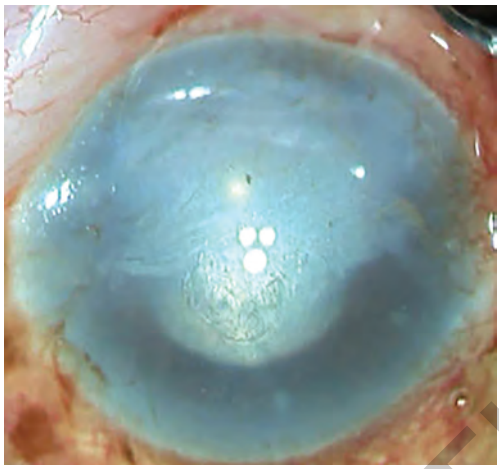


Fig. 2.4: Preoperative image of an eye showing decompensated cornea and malpositioned intraocular lens.

lagophthalmos, entropion, and ectropion should be corrected prior to the surgery. Globe position and extraocular movements should also be assessed in preliminary examination. Lacrimal system obstruction has to be checked in all eyes before surgery by examining the sac region, looking for regurgitation from sac on pressing the sac region, punctum status, and syringing. Any preexisting nasolacrimal duct obstruction has to be treated by appropriate procedure like dacryocystorhinostomy before EK.

Tear Film

Diminished tear production and dry eye may predispose to ocular surface problems and prevent normal epithelial growth postoperatively. Schirmer 1 and 2, tear film breakup time, and tear meniscus examination can help in tear film analysis. An intact trigeminal and facial nerve is necessary for ensuring adequate corneal protection and lid closure.

Intraocular Pressure

Eyes after any keratoplasty will require prolonged topical steroids. Therefore, one has to rule out any predisposition conditions for rise in intraocular pressure (IOP) or glaucoma prior to surgery. This will let the surgeon inform the patients about the surgical outcomes and risks. Goldmann applanation tonometer is the standard method in IOP evaluation. Any eyes with ocular hypertension have to be evaluated for glaucoma. Additional evaluation like gonioscopy and visual field analysis has to be performed in specific cases. Optimization of IOP is a prerequisite before surgery.

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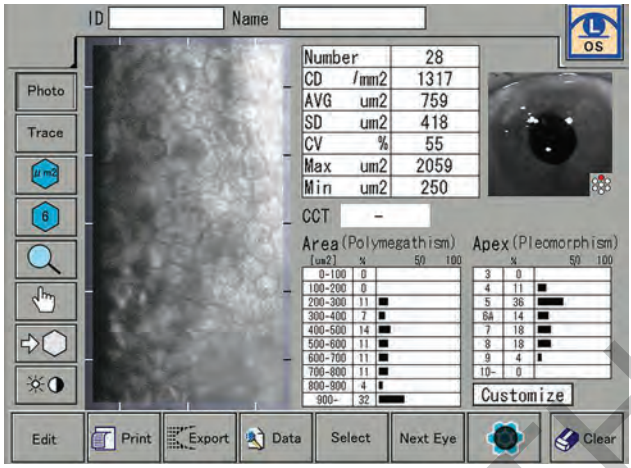


Fig. 2.5: Specular microscopy showing polymegathism.

Control of Inflammation

Patients with previous uveitis have the risk of recurrent inflammation after EK. Especially with autoimmune conditions like rheumatoid arthritis or systemic collagen diseases; there is added risk for ocular inflammation. The anterior chamber cellular grading may be hindered in the patients with coexisting corneal haze and uveitis. Hence one can use optical coherence tomography to assess the cellular reaction in such eyes.[12] Preexisting inflammation should be controlled before surgery with adequate steroids. Preliminary treatment with topical steroids prior to surgery improves outcome in eyes that are chronically inflamed.

Ancillary Investigations

- *Specular microscopy*: Specular microscopy is helpful in confirming the morphological changes of endothelium. It provides endothelial cell count, presence of polymorphism or polymegathism (Fig. 2.5), and as well as takes a photographic record. Wide-field specular microscopy can be performed throughout the entire cornea thus allowing the study of regional variability.
- *Confocal microscopy*: Confocal microscopy is used to study individual cell layers of cornea even in cases with edema and scarring. It provides more spatial resolution and magnification of image.
- *Anterior segment optical coherence tomography*: This is a noncontact imaging device that can provide intrinsic details of the corneal layers. It provides analysis of endothelial guttate changes, integrity of Descemet's membrane endothelial complex (Fig. 2.6), depth and size of scars or

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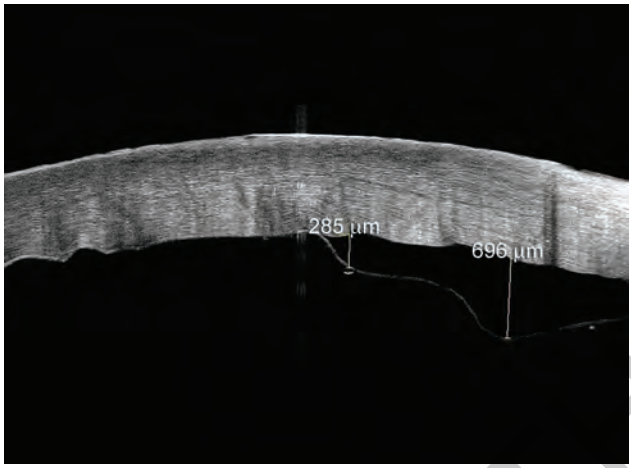


Fig. 2.6: Spectral domain optical coherence tomography showing detached Descemet's membrane and endothelial complex.

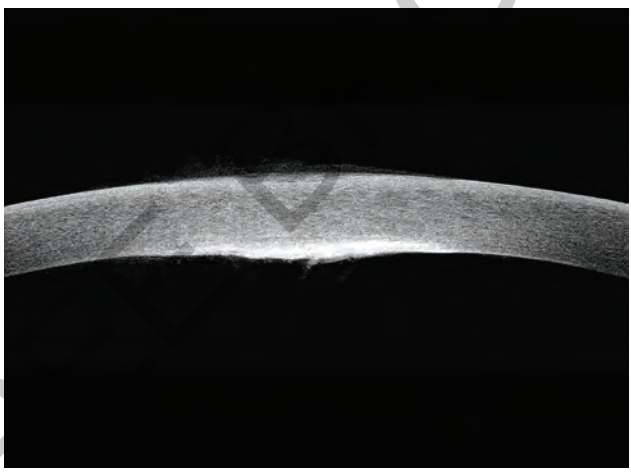
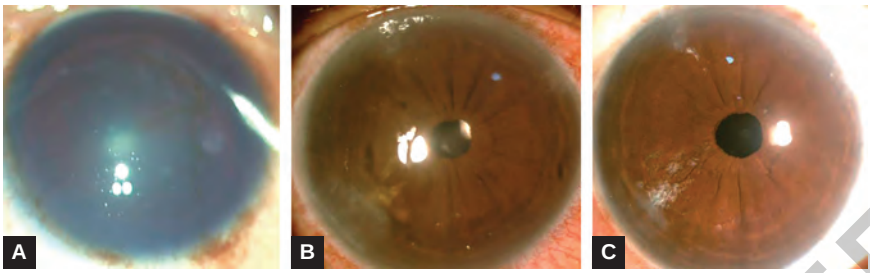


Fig. 2.7: Spectral domain optical coherence tomography showing dense Descemet's membrane scar.

opacity (Fig. 2.7), and is also useful in assessing presence of corneal bullae or edema.

- *Corneal pachymetry*: Pachymetry measures the corneal thickness, which is a sensitive indicator of endothelial physiology. Normal cornea has an average central corneal thickness of about 530–540 µm. Folds in Descemet's membrane are first seen when corneal thickness increases by 10%. Pachymetry can be measured by ultrasound method or by optical coherence tomography.

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Figs. 2.8A to C: (A) Serial photograph showing clinical improvement from preoperative Fuchs dystrophy (PDEK phaco and IOL done) to postoperative period; (B) 1 month; and (C) 6 months (vision 20/20).

- *Clinical photography*: Serial clinical photography of the cornea may add additional information for the surgeon in planning for management and follow-up (Figs. 2.8A to C). Improvement of corneal clarity from preoperative to postoperative period, preoperative scar status, postoperative epithelial toxicity, and progression or regression of neovascularization can be documented.
- *Conjunctival microbial swab*: Conjunctival microbial analysis is required in an eye which has shown previous recurrent conjunctival infection or inflammation. Especially in one-eyed patients it is mandatory before ocular surgery. If the conjunctival fornix swab is noted to have bacterial growth, it has to be treated with appropriate antibiotics and rechecked after 3 days. EK can be performed only after the swab becomes negative for growth. Patients with prior nasolacrimal duct obstruction and those with fellow eye prosthesis are the other candidates who will require preoperative conjunctival swab analysis.
- *Corneal topography and aberrometry*: Corneal topography will be required in some eyes with coexisting thinning and especially for academic reasons if the surgeon wants to follow-up the corneal topography postsurgery.[13] Corneal haze will hinder aberrometry analysis in majority of patients preoperatively; however postoperatively aberration profiles can be documented and assessed for research purpose.
- *Biometry*: Ocular biometry including IOL power calculation details (Fig. 2.9) are required in all eyes undergoing EK or for that matter any keratoplasty. The simple reason is that whenever there is intraoperative requirement of exchange of IOL, the IOL power calculations have to be there for the surgeon to use it.
- *Donor graft assessment*: Donor cornea evaluation is the important preoperative assessment in EK. Slit lamp examination for grading of corneal status (epithelium, stroma, endothelium) and endothelial cell count to assess the viability of the cornea for EK has to be determined before

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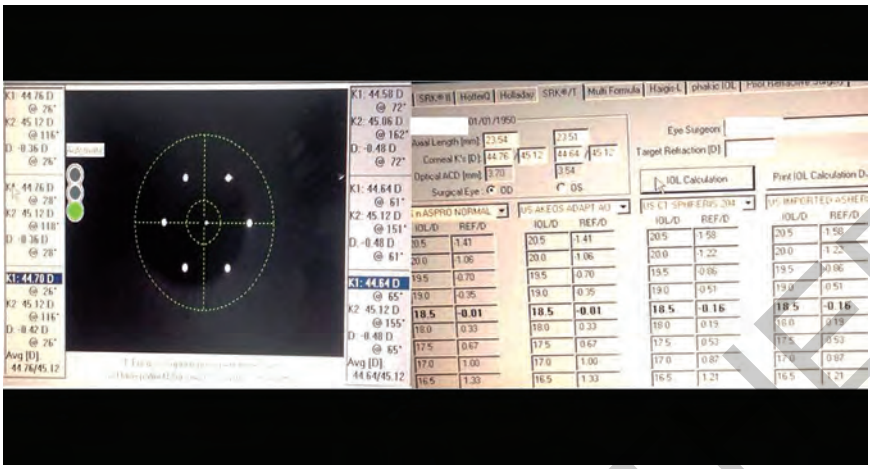


Fig. 2.9: Ocular biometry being performed for intraocular lens power calculation.

surgery. Endothelial cell count more than 2,500 cells/sq. mm can be utilized for EK procedures. Culture and microbial analysis of the donor graft is required in all cases to confirm the absence of infective source before transplantation. Donor corneas with preexisting Descemet's fold, damaged endothelium, and scar are not ideal for EK.

General Medical Evaluation

Medical evaluation by a physician is required to assess the patient's anesthetic risks and stabilization of the any medical conditions is necessary if general anesthesia is planned. Systemic morbid conditions like diabetes, hypertension, and other ailments need to be managed before corneal surgery. Patients on blood thinning drugs require few days of clearance before surgery. For repeat grafts requiring systemic immunosuppression, one should exclude the diseases that contraindicate its use such as active infection, tuberculosis, and viral hepatitis.

SUMMARY

The objective of any keratoplasty is to provide the best visual potential and less postoperative complications to the patient. Unless the initial assessments are meticulously performed in terms of correct diagnosis, proper control of comorbid ocular pathology, and ideal selection of procedure, the postoperative outcome becomes affected. Therefore, the clinical history, routine examination, and appropriate ancillary tests in specific patients are vital in good preoperative evaluation to provide the desired functional and anatomical results.

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