Endothelial Keratoplasty

Essay
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By

Gina Gamil Aziz Gaballa
M. B., B.Ch.
Ain Shams University

Under the supervision of

Prof. Dr. Sheriff Elwan
Professor of Ophthalmology
Faculty of Medicine
Ain Shams University

Dr. Karim Magdy
Lecturer of Ophthalmology
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams University
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بكالوريوس الطب والجراحة

تحت إشراف

أ.د. شريف علوان

أستاذ طب وجراحة العيون
كلية الطب -جامعة عين شمس

د.كريم مجدى

مدرس طب و جراحة العيون
كلية الطب -جامعة عين شمس

كلية الطب
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Gina Gamil Aziz

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List of Abbreviations

AAC	**Artificial Anterior Chamber**
ABK	Aphakic Bullous Keratopathy
ALK, ALKP	Anterior Lamellar Keratoplasty
PLKP	Posterior Lamellar Keratoplasty
BCVA	Best Corrected Visual Acuity
BSS	Balance Salt Solution
CDB	Chemically Defined Bioadhesive
CMV	Cytomegalovirus
DALK	Deep Anterior lamellar Keratoplasty
DLEK	Deep Lamellar Endothelial Keratoplasty
DM	Descemet's Membrane
DMEK	Descemet's Membane Endothelial Keratoplasty
DSAEK	Descemet's Stripping Automated Endothelial Keratoplasty
DSEK	Descemet's Stripping Endothelial Keratoplasty
DXEK	Descemetorhexis and Endothelial Keratoplasty
DX	Descemetorhexis

ECD	Endothelial Cell Density
EK	Endothelial Keratoplasty
FS	Femtosecond
ICE	Iridocorneal Endothelial Syndrome
ICG	Indocyanine green
IOL	Intra Ocular Lens
LASIK	Laser Insitu keratomiluesis
LKP, LK	Lamellar Keratoplasty
µ	Micron
mm	Millimeters
mm^2	Cubic millimeters
PBK	Pseudophakic Bullous Keratopat
PGF	Primary Graft Failure
PLK	Posterior Lamellar Keratoplasty
PKP, PK	Penetrating Keratoplasty
PPMD	Posterior Polymorphous Corneal Dystrophy
Tencell	True Endothelial Cell Transplantation

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INTRODUCTION

Corneal transplantation has been used to treat visual loss due to corneal disease for over 100 years, with the first successful full-thickness human transplant performed in 1905.[1] It has advanced dramatically over the past 25 years due to better surgical techniques, medications, and donor storage advances. [2]

Penetrating Keratoplasty is an indiscriminate form of surgery, as it replaces all layers of the cornea, regardless of the tissue layer that is responsible for the visual deficit. For example: In the case of anterior stromal scars with healthy endothelium, a Penetrating Keratoplasty removes the scar but sacrifices the healthy endothelium. In the case of endothelial dysfunction due to disease or trauma, Penetrating Keratoplasty replaces the endothelium with healthy tissue, but sacrifices the normal corneal topography and also the structural integrity of the anterior corneal tissues. [3]

Endothelial keratoplasty is the selective replacement of diseased endothelium with healthy donor endothelium. First performed in humans in 1998 by Garret Melles, the procedure involved the removal of the endothelium and posterior stroma from a recipient cornea and replacement with a similarly sized donor stroma and endothelial tissue. Dr. Melles termed the procedure posterior lamellar keratoplasty .[3]

In March 2005, Terry MA modified the procedure, terming it deep lamellar endothelial keratoplasty (DLEK) and performed the first endothelial keratoplasty surgery in the United States.[4]

Dr. Melles proposed that stripping Descemet's membrane from the back of the recipient cornea would more easily remove the recipient endothelium (compared with cutting out the posterior stromal tissue) and would result in a smoother recipient interface surface. This modification has been popularized as Descemet's stripping endothelial keratoplasty (DSEK).[5]

In order to compare techniques of endothelial replacement surgery, it is worthy to consider what the ideal goals of endothelial transplant surgery should be. The ideal endothelial transplantation procedure should fulfill, six goals:

(1) An optically pure cornea.
(2) A highly predictable and stable corneal power.
(3) A healthy donor endothelium that resolves all edema.
(4) A tectonically stable globe, safe from injury and infection.
(5) A surgical technique that is quickly and easily acquired.
(6) A smooth surface topography without significant change in astigmatism from preoperative to postoperative status.[6]

CHAPTER ONE
Definitions

General Background

The cornea, a clear dome-shaped membrane that covers the front of the eye, is a key refractive element of the eye. Layers of the cornea consist of the epithelium (outermost layer); Bowman's layer; the stroma, which comprises approximately 90% of the cornea; Descemet's membrane; and the endothelium. The endothelium removes fluid from the stroma and limits its entry, thereby maintaining the ordered arrangement of collagen and preserving the cornea's transparency **Figure (1)**. For optimal vision, all layers of the cornea must be of normal shape and curvature and free of any cloudy or opaque areas.[7]

Indications for corneal transplant include corneal dystrophies and degenerations (e.g., keratoconus, Fuch's dystrophy), bullous keratopathy, and failure of a prior corneal transplant. Scarring from infection or trauma may also cause corneal changes that may require surgical intervention.[8] While some corneal damage can be treated by performing corrective surgery on the surface of the cornea, more often vision can only be restored only with a corneal transplant. Corneal transplant or keratoplasty is the surgical replacement of a diseased or scarred cornea. Corneal tissue used for transplant surgery is typically donated through a certified eye bank and undergoes extensive testing prior to use for transplantation. Since the cornea normally contains no blood vessels, this type of transplant is associated with a low rejection

rate. Generally blood and tissue typing are not needed in corneal transplants.[8]

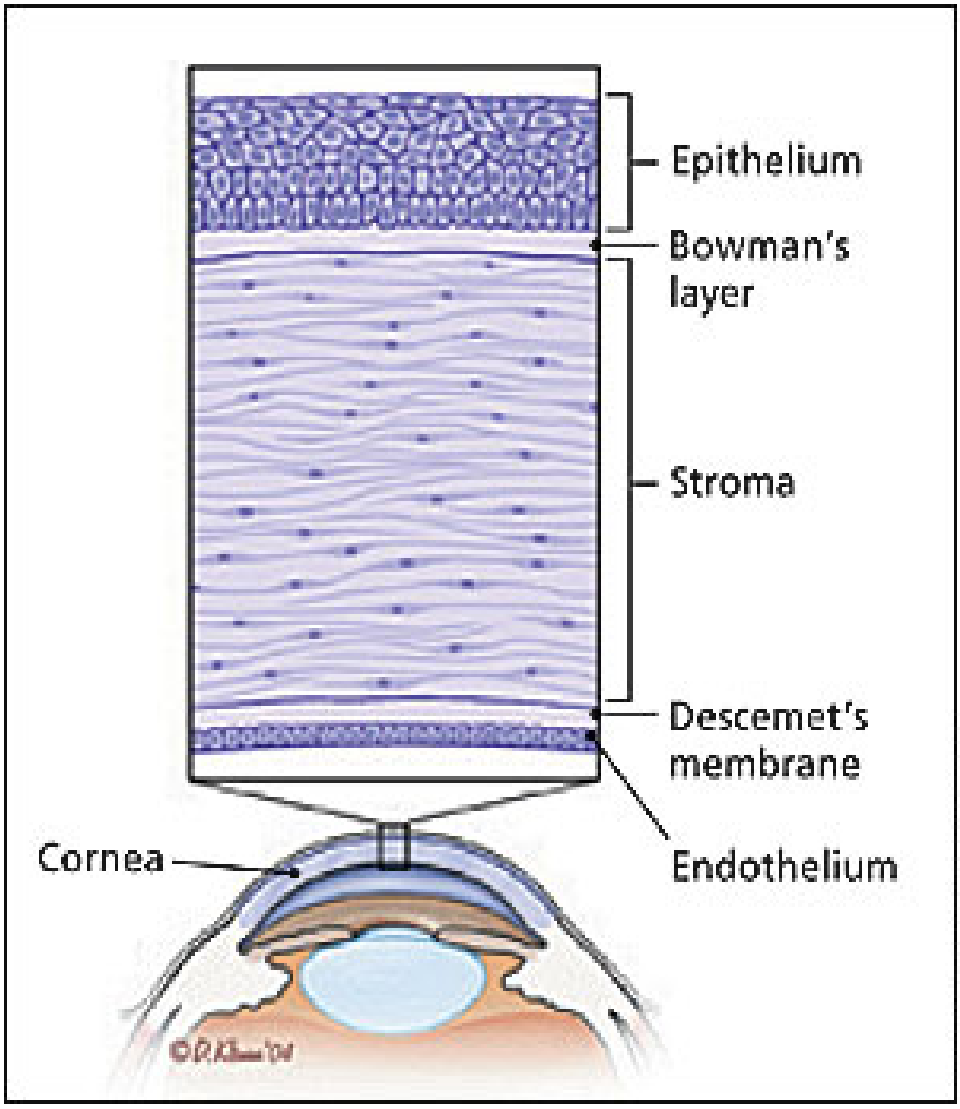

Figure (1): Anatomy of the cornea. the cornea has five distinct, transparent layers; from anterior to posterior they are epithelium, Bowman's layer, stroma, Descemet's membrane, and endothelium. [9]

Penetrating Keratoplasty (PK):

Penetrating keratoplasty is a procedure consisting of full-thickness replacement of the cornea.[10] It is indicated for full-thickness corneal disease.[11]

Lamellar (Non-Penetrating) Keratoplasty:

Lamellar or non-penetrating keratoplasty is a corneal transplant procedure in which a partial thickness of the cornea is removed. The diseased tissue is replaced with a partial-thickness donor cornea.[12]

Deep anterior lamellar keratoplasty (DALK):

DALK is used when the pathology is confined to front layers of the cornea. In this procedure, most of the anterior layers of the cornea (i.e., epithelium, Bowman's membrane, stroma) are removed.[12]

Posterior lamellar keratoplasty (PLK)

The PLK is defined as any corneal lamellar procedure where the Descemet's membrane and endothelium are excised with or without host corneal stroma. It includes Deep lamellar keratoplasty (DLKP), Descemet's membrane endothelial keratoplasty (DMEK) and Descemet stripping with endothelial keratoplasty (DSEK). Microkeratome could be used to prepare the donor tissue in DSEK surgery in this case the procedure is termed "Descemet's stripping automated endothelial keratoplasty" (DSAEK) or by Femtosecond-laser (Femto-PLK).[13]

Deep lamellar keratoplasty (DLKP):

DLKP is a surgical method that completely removes pathological corneal stromal tissue down to the endothelium, followed by transplantation of donor tissue. The technique was modified with redesigned instrumentation, and renamed deep lamellar endothelial keratoplasty (DLEK).[14]

Descemet's membrane endothelial keratoplasty (DMEK):

In 1998, a technique for selective transplantation of Descemet's membrane through a self-sealing 3.5 mm clear corneal incision named Descemet's membrane endothelial keratoplasty (DMEK).[15]

Descemet's stripping endothelial keratoplasty (DSEK):

DSEK involves the scraping of the Descemet's membrane from the recipient cornea instead of the lamellar dissection and excision procedures performed in DLKP and DLEK. DSEK is also less technically challenging than DLEK.[14]

Descemet's stripping automated endothelial keratoplasty (DSAEK):

When the donor tissue is prepared with a microkeratome instead of manually, the procedure is termed Descemet's stripping automated endothelial keratoplasty (DSAEK), and this method is currently the preferred technique. The popularity of EK has