Faculty of Medicine

Recent Advances in Corneal Grafting

Essay
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by

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LIST OF ABBREVIATIONS

AAC	Artificial Anterior Chamber
ALR	Anterior lamellar resection
ALTK	Automated Lamellar Therapeutic Keratoplasty
AMT	Amniotic Membrane Transplantation
ATP	Adenosine Triphosphate
B.M.	Bowman's Membrane
BSS	Balanced Salt Solution
cAMP	Cyclic Adenosine Monophosphate
CJD	Creutzfelt Jacob Disease
CL	Contact Lens
D	Diopters
DALK	Deep anterior lamellar keratoplasty
DLK	Deep Lamellar Keratoplasty
DLR	Deep lamellar resection
DM	Descemet's Membrane
DXEK	Descematorhexis with endokeratoplasty
EBAA	Eye banking Association of America

EK	Endothelial Keratoplasty
FDLEK	Flap associated deep lamellar endothelial keratoplasty
FEMTO-PLAK	Femtosecond posterior lamellar keratoplasty
FSLK	Femtosecond Lamellar Keratoplasty
FTDGE	Full thickness donor graft with endothelial
HBsAg	Hepatitis B surface antigen
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency virus
HTLV	Human T lymphotropic virus
IOL	Intraocular lens
IOP	Intraocular Pressure
KC	Keratoconus
LASIK	Laser in situ Keratomilesis
LK/LKP	Lamellar Keratoplasty
MALK	Middle anterior lamellar keratoplasty
MDLK	Maximum depth lamellar keratoplasty

MK Med	McCarey Kaufman Medium
mm	Millimeter
MSR	Middle stromal resection
Na –K ATPase	Sodium potassium adenosine triphosphatase
PC IOL	Posterior Chamber IOL
Phaco	Phacoemulsification
PKP/PK	Penetrating Keratoplasty
PLK	Posterior lamellar keratoplasty
SALK	Superficial anterior lamellar keratoplasty
SCT	Stem cell transplantation
TALK	Total anterior lamellar keratoplasty
TLR	Total lamellar resection
Um	Micrometers
VA	Visual Acuity

INTRODUCTION

Penetrating keratoplasty (PKP): the PKP is full-thickness corneal replacement, it violates both the Bowman's layer and Descemet's membrane ***(Malbran et al, 2004)***

Penetrating keratoplasty has thus been the most common corneal transplantation procedure for visual restoration for many years. Although penetrating keratoplasty has been shown to be effective and safe for most anterior segment pathologies, there are persistent long term risks such as endothelial failure and immunological graft rejection ***(Thompson et al, 2003)***.

Lamellar keratoplasty has rapidly gained popularity among corneal surgeons in the past few years. Improved instrumentation, refinements in microsurgical techniques, availability of new artificial anterior chambers, and micrkeratomes seem to have forward propelled this renewed interest in LKP to newer heights. Additionally, anterior LKP (ALKP) for the most part is an extraocular, non open-sky, less invasive procedure than PKP, and it avoids a multitude of intraocular complications as endophthalmitis, glaucoma, iatrogenic cataract formation, anterior synechiae formation, and iris prolapse. In contrast, posterior LKP (PLKP) is an intraocular procedure ***(Malbran et al, 2004).***

Lamellar keratoplasty was the main surgical approach for corneal surgery in the beginning of the 20th century. It was abandoned in the 1960's, when penetrating grafts were adopted, mainly due to the technical difficulties in performing a stromal lamellar dissection that would allow a comparable improvement in visual acuity ***(Malbran et al, 2004)***

Developments in field of lamellar include Malbran's "peeling off" of the corneal stromal technique in keratoconus, and Barraquer's development of "refractive lamellar techniques" and his design of the microkeratome, and Vasco-Posada's development of the deep lamellar technique, which he called "intralamellar homokertoplasty". These developments prevented the defect caused by manual dissection on the stromal lamellae, and created the perfect conditions for a lamellar technique, which are:

1. Deep interface.
2. Posterior layers of uniform thickness
3. Uniform and smooth donor and recipient surfaces
4. High quality donor
5. Adequate graft thickness
6. Good coaptation of the edges
٧. Careful cleaning of the interface.

(Malbran et al, 2004)

In the past years, several lamellar keratoplasty surgical techniques have been developed, modified or improved in the past years, including microkeratome assisted anterior and posterior lamellar keratoplasty, anterior lamellar keratoplasty using air-dissection or visco-dissection, sutureless posterior lamellar keratoplasty, LASIK for postkeratoplasty astigmatism, and excimer laser assisted keratophakia for keratoconus or to manage complications after LASIK. These procedures may continue to gain interest as alternative procedures for a penetrating keratoplasty in the treatment of various corneal disorders ***(Alio et al, 2002)***

The development of the femtosecond laser assisting in anterior and posterior LKP has been a breakthrough in automated LKP. It holds several advantages including precision and decreased surgical time ***(Sarabaya et al, 2002).***

History

The techniques of corneal grafting were first reported in the ophthalmic literature in 1824 by Reisinger, with experiments on rabbits. Von Hipple, in 1877, was the first to show an improvement in vision using his standardised technique, which forms the basis of modern corneal transplantation. In 1906, Zirm

was credited for the first corneal transplant to retain a moderate degree of transparency ***(Castroviejo, 1932)***.

Since then, much work has gone into perfecting this operation, not only by modifications in the techniques, but also by the introduction of the operating microscope and associated improvements in microsurgical instruments and suture materials ***(McCarey and Kaufmann, 1974)***.

Much work and progress has also been achieved in the storage and preservation of donor endothelial viability. In 1934, Filatou showed that grafts were viable if removed from the cadaver 41 hours after death. Initial storage media included physiological saline, sterile olive oil, and haemolysed cadaver blood ***(McCarey and Kaufmann, 1974)***.

The introduction of M-K medium by McCarey and Kaufman enabled donor corneas to be stored for 3 to 4 days. Further advances based on tissue culture techniques have now enabled the preservation of donor tissue for up to 30 to 40 days ***(Williams et al, 1992)***.

Despite these good survival rates, graft rejection episodes are not uncommon. The reason why so few grafts are lost is thought to be the early diagnosis and aggressive management of graft rejections ***(Paglen et al, 1982)***.