Recent Advances in Keratoprosthesis

Essay

Submitted for Partial Fulfillment of Master Degree in Ophthalmology

Presented by

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(M.B., B.Ch.)

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List of Abbreviations

Abbrev.	
ADAS	Adipose-Derived Adult Stem
DALK	Deep anterior lamellar keratoplasty
DSEK	Descemet's stripping endothelial keratoplasty
EBT	Electron beam tomography
EK	Endothelial keratoplasty
ERG	Electrophysiological studies as electroretinogram
IK	Interstitial keratitis
IOP	Intra ocular pressure
KPro	Keratoprosthesis
MDCT	Multi-detector computed tomography
MMP	Mucous membrane pemphigoid
MRI	Magnetic resonance imaging
NHC	Normal Human Conjunctival
OCP	Ocular cicatricial pemphigoid
ODA	Osteodental-acrylic
OOKP	Osteo-odonto-keratoprosthesis
PBK	Pseudophakic bullous keratopathy
PEA	Polyethylacrylate
PHEMA	Poly-hydroxyethyl methacrylate
PK	Penetrating keratoplasty
PMMA	Polymethyl methacrylate
RPM	Retroprosthetic membrane
rTPA	recombinant Tissue Plasminogen Activator
SJS	Stevens-Johnson syndrome
TAC	Transit amplifying cells
TD	Terminally differentiated
VEP	Visual evoked potential

First and foremost, all thanks to my great God as He is the main cause of my being here now and for any success I had in my life

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My deepest thanks to my family, to them I owe everything I am or will be.

✍ *Marian Maged Abd elmissieh*

INTRODUCTION

Cornea is avascular convex slightly elleptical shaped anterior transparent part of the globe .It is the main medium responsible for the refraction of light entering the eye and provides a clear media through which the light can travel ***(Cao et al, 2002).***

Corneal transparency is the result of a number of related factors; the regularity and smoothness of the covering epithelium; its avascularity; and the regular arrangement of the extracellular and cellular components in the stroma, which is dependent on the state of hydration, metabolism and nutrition of the stromal elements and the endothelium ***(Doane et al, 1996).***

Diseases affecting the cornea are major cause of blindness worldwide, second only to cataract in overall importance. Ocular trauma and corneal ulceration are significant causes of corneal blindness that are often underreported but may be responsible for 1.5–2.0 million new cases of monocular blindness every year ***(Bascom et al, 2003).***

In an attempt to prevent and decrease the incidence of blindness due to corneal factors many procedures have been discussed, beginning by trials to treat and prevent infectious diseases as trachoma. Also surgery has been greatly taken in consideration so corneal transplantation i.e. lamellar keratoplasty and penetrating keratoplasty were introduced as treatments for corneal blindness ***(Devera, 1997).***

Although these trials were of value, still, their complications made searching for another solution a must. So the idea of keratoprosthesis began to appear ***(Cardona, 1962).***

Dry eye syndrome due to cicatricial pemphigoid, Stevens-Johnson syndrome, severe chemical burns either due to caustics, irritant gases or contact anesthetics, is considered as an indication of artificial cornea. Also, patients with repeated graft failure due to immune reaction have a poor prognosis for subsequent keratoplasty and are thus candidates for artificial cornea ***(Lacombe, 1993).***

Keratoprosthesis is a surgical procedure where a severely damaged or diseased cornea is replaced with an artificial cornea. While conventional cornea transplant uses donor tissue for transplant, an artificial cornea is used in the Keratoprosthesis procedure. The surgery is performed to restore vision in patients suffering from severely damaged cornea due to congenital birth defects, infections, injuries and burns ***(Klufas and Starr, 2009).***

Unlike most prosthesis implanted in the human body, a keratoprosthesis protrudes through tissues to the external environment, preventing a closed seal of the supporting tissue around it. Attempts to adhere the keratoprosthesis to ocular surface have been tried since Neussbaum implanted a glass one in 1853 ***(Kain and Lund, 1988).***

The devices most widely used today include the Alphacor artificial cornea, Boston keratoprosthesis, Osteo-odonto-keratoprosthesis (OOKP) ***(Doane et al, 1996).***

The Boston Keratoprosthesis is assembled utilizing a central optical cylinder with a surface plate which functions as a new entrance pupil and cornea refracting surface. It is fixed to a ring of donor cornea stroma surrounding the 3 mm optical cylinder and fastened by a fenestrated back plate and locking titanium washer. The device can then be implanted into a recipient eye using standard cornea transplant techniques. A hydrophilic bandage lens, worn over the entire surface, has been effective in eliminating many ocular surface problems common to cornea transplants ***(Dohlman and Harissi-Dagher, 2007).***

The Alphacor is a synthetic hydrogel artificial cornea with a biointegrable skirt region. The synthetic cornea is 7.0mm in total diameter, with a functional optic diameter of just over 4.0mm and a thickness 0.5mm. It is used in scarred, vascularized, or diseased corneal tissue with multiple graft failures ***(Hicks et al, 2003).***

The OOKP is an autograft used for the treatment of severe corneal opacities not suitable for corneal transplantation. The cornea is replaced by a polymethyl methacrylate (PMMA) optical cylinder glued to a biological support (haptic) made by human living tissue (the autologous osteodental lamina).The

efficacy of OOKP surgery is related mostly in the uniqueness of the material that composes the KPro: not only autologous tooth but also alveolar bone with its ligament and periosteum, all covered by autologous oral mucosa. This living material is the most suitable as a long-term support to the optical component of the keratoprosthesis, with the lowest risks of extrusion and infection ***(Strampelli, 1963).***

AIM OF THE WORK

The aim of this study is to review the corneal diseases that may not suit keratoplasty and the types of keratoprosthesis available nowadays and the advantages and disadvantages of each.