Surgical solutions to presbyopia

Essay

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By

Ashraf Zakaria Hedier
M.B.B.Ch
Faculty of medicine, Ain Shams University

Under supervision

Prof. Dr.Ismail Ibrahim Hamza
Professor of ophthalmology
Faculty of medicine, Ain Shams University

Prof.Dr. Raafat Ali Rehan
Assistant professor of ophthalmology
Faculty of medicine, Ain Shams University

Cairo. Egypt

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الوسائل الجراحية الحديثة لاصلاح طول النظر الشيخوخي

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تحت اشراف

ا.د.اسماعيل ابراهيم حمزة
أستاذ طب وجراحة العيون
كلية الطب جامعة عين شمس

ا.د.رأفت على ريحان
أستاذ مساعد طب وجراحة العيون
كلية الطب جامعة عين شمس

القاهرة

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Surgical solutions to presbyopia

Ashraf Zakaria Hedier,
M.B.B.Ch, Faculty of medicine, Ain Shams University

Presbyopia which faces many people after ٤٠ yrs is a big problem as it make patient complains from headache, strain and blurring of vision after reading small font print.

The pathophysiology of presbyopia is likely to result from deterioration in structure and function of a number of inter-related tissues. Changes in crystalline lens dimensions with age, the associated change in geometry of zonular attachments, and changes in viscoelastic properties of the lens capsule and lens matrix would, however, appear to be the principal correlates for the onset of presbyopia this changes approved by many theories like Helmholtz theory, Schachar theory.

The Surgical solutions is the challenge as there are ٣ ways by corneal approach like monofocal lasik and multifocal lasik , scleral approach like scleral expansion band, lenticular approach like IOL implantation.

*First, thanks are all due to **Allah** for Blessing this work until it has reached its end, as a part of his generous help throughout our life.*

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Ashraf Zakaria Hedier

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List of abbreviations

ACS	Anterior Ciliary Sclerotomy
AIOL	Accommodative IOL
ASCRS	American Society of Cataract and Refractive Surgery
BSCVA	Best Spectacle Corrected Visual Acuity
CL	Contact Lenses
CK	Conductive keratoplasty
D	Diopter
FDA	Food and Drug Administration
GP	Gas Permeable
IOL	Intra Ocular Lens
J	Jaeger
LAPR	Laser Peripheral Reversal
LaserACE	Laser Anterior Ciliary Excision
LASIK	Laser Assisted Insitu Keratomileusis
NEVEX	Nidek Advanced Vision Excimer
PAL	Progressive Addition Lenses

PAC	**Pseudoaccommodative Cornea**
PAS	**Periodic Acid Schiff**
PML	**Peripheral Multifocal Lasik**
RD	**Retinal Detachment**
SEBs	**Scleral Expansion Band surgery**

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Aim of work

This work aims to review on the new trends of surgical solutions to presbyopia.

Introduction

Presbyopia (Greek word "presbys" meaning "old person") describes the condition where the eye exhibits a progressively diminished ability to focus on near objects with age. Similar to grey hair and wrinkles, presbyopia is a symptom caused by the natural course of aging. Presbyopia is usually first noticed between the ages of ٤٠-٥٠. The ability to focus on near objects declines throughout life, from an accommodation of about ٢٠ dioptres (ability to focus at ٥٠ mm away) in a child, to ١٠ dioptres at ٢٥ years (١٠٠ mm) and leveling off at ٠,٥ to ١ dioptre at age ٦٠ (ability to focus down to ١-٢ meters only).***(Robert A,)***

The first symptom is difficulty in reading fine print, particularly in low light conditions, eyestrain when reading for long periods, blur at near or momentarily blurred vision when transitioning between viewing distances. Many presbyopes complain that their arms have become "too short" to hold reading material at a comfortable distance**.** ***(Robert A,)***

Presbyopia's exact mechanisms are not known with certainty; however, the theories like Helmholtz, Schachar theory, Lenticular theory, Disaccommodation theory, Geometric Theory, and Multifactorial Theories support that loss of elasticity of the capsule of the crystalline lens, or changes in the lens's curvature from continual growth and loss of power of the ciliary muscles may be the cause**..*** ***(Glasser A & Campbell, ١٩٩٧)***

Strategies of surgical solution to presbyopia

A-Non accommodative treatment

١-Monovision:

LASIK:

Using Excimer laser.
Correct dominant eye for distance & non-dominant eye for near.

٢-Conductive keratoplasty:

Using radiofrequency energy.
Correct dominant eye for distance & non-dominant eye for near.

٣-Multifocal LASIK:

The corneal surface is ablated in concentric zones(far & near)
PARM technique:center for far & prephery for near.
Ruiz technique:center for near & prephery for far.

٤-Multifocal IOL:

Types
a-Refractive optics: Eg.AMO array foldable silicon IOL
b-Diffractive optics:
Eg.Acrysof restor&tecnis.multifocal.

٥-Intracorneal hydogel bifocal lens:

-Hydogel implant is inserted into the cornea to produce a bifocal effect.

-١,٥-٣,٠٠ d.

B-Accommodative treatment

١-Scleral expansion:

Idea: expanding scleral diameter increase the effective working distance of the ciliary muscle(more space aviable for it to contract).

Scleral expansion bands:

٤ small arched PMMA implants are tunnled through the sclera overlying the ciliary body just posterior to the lens equater.

These implants result in localized increase in globe diameter over the lens equater,effectively reversing the crowding of the ciliary space due to lens growthand restoring zonule function on the crystalline lens.

٢-Anterior ciliary sclerotomies (RK of the sclera):

- ٤ small radial sclerotomy incisions in each quatrant of the sclera inbetween recti&over the ciliary muscle.

-٠,٥mm back from surgical limbus.

-٩٥٪ of scleral thickness.

٣-Accommodative IOL:

Mechanism ciliary muscle contraction is transmitted to IOLIOL moves in an antero-posterior axial direction with ciliary muscle contraction to enable accommodation.

Crysalens:

Polyamide haptics(hinged).-

Silicon optic(biosil). -

The corneal anatomy

The cornea is a transparent avascular tissue that forms together with the precorneal tear film the major refracting surface for the eye.The diameter of the cornea is ١١,٦ to ١٢,٦ mm horizontally and ١٠,٦ to ١١,٧ mm vertically.The thickness of the cornea varies from ٠,٥٠ to ٥٦٠ um centrally to ٦٣٠ to ٦٧٠ um peripherally. The radius of curvature of the anterior surface of the cornea ranges from ٧,٢ to ٨,٤ mm, the radius of curvature of the posterior surface ranges from ٦,٢ to ٦,٨ mm**(Snell,١٩٩٨)**

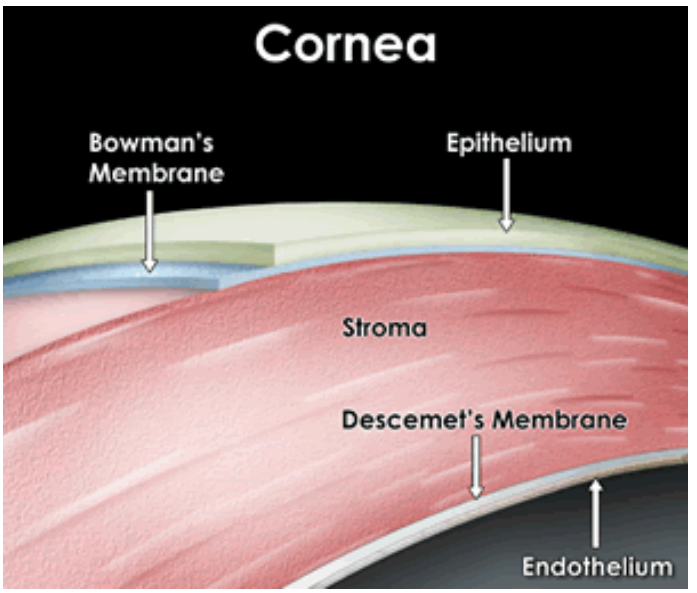

Figure (١): Layers of the cornea**((Mission for vision,٢٠٠٥)**

The epithelium:

Corneal epithelium is the anterior-most cell layer of the cornea. It is approximately ٥٠ μm thick in the central human cornea (about ١٠٪ of the total thickness). It is stratified squamous non-keratinized typically ٥ to ٧ layers thick, consisting of the flattened squamous cell layer, wing

cells and posterior basal columnar cells. The wing cell layer is two or three cells thick and they have lateral, thin wing like extensions from a rounded cell body. The basal layer is made of one layer of columnar cells regular in shape and size. The basal cells are adherent to the underlying basement membrane which is about ٤٨ mm thick is strongly attached to the underlying bowman's membrane. They are metabolically active, after they undergo mitosis, a daughter cell begins its journey of movement toward differentiation and desquamation from the apical surface **(Sun, V. A. (١٩٨١)**

The microvilli are about ٠,٥ um high, ٠,٣ um wide and ٠,٥ um apart. Dendritic cells have been identified in the corneal epithelium, they are important for the immune recognition system responsible for presentation of antigen to lymphocytes **(Pfister, B. N. (١٩٧٧).**

The Bowman's membrane:

It is formed of interlacing collagen fibrils, ٨-١٤ um in thickness. At the periphery, it becomes loosely arranged and end abruptly at the limbus. Ultra structurally, the collagen fibrils are uniform in size and lying in a ground state. Fibril diameter is ٢٤ to ٢٧ nm. The deep fibrils become more orderly in their orientation and blend with the fibrils of the anterior stroma. The compacted arrangement of the collagen confers great strength to Bowman's membrane so it resists trauma and rupture **(Tripathi, T. B. ١٩٨٤)**

The stroma:

It forms about ٩٠٪ of the corneal thickness (٥٠٠ um in thickness). It is formed of collagen fibrils arranged regularly in lamellae perpendicular to each other and parallel