EVALUATION OF PRESBYMAX IN CORRECTION OF PRESBYOPIA IN HYPEROPES

Thesis
Submitted for partial fulfillment of M.Sc. Degree in Ophthalmology

By

Mohamed Beshr Kenawy
M.B.B.CH
Department of Ophthalmology
Cairo University

Supervisors

Dr. Mahomoud Abou Steit
Professor of ophthalmology
Cairo University

Dr. Amr Elbakry
Assistant Professor of ophthalmology
Cairo University

2012

ABSTRACT

LASIK monovision represents a well-established and highly satisfactory surgical correction to achieve functional near and distant vision without corrective lenses.

Multifocal corneal ablation, using the Excimer laser, has been devised to improve near vision for correcting presbyopia by creating a multifocal corneal surface. The flattened zone reduces the refractive power and distance vision goes through this zone, whereas the steepened zone increases the refractive power and near vision goes through this zone, resulting in a clear image on the retina.

Key Words:

PresbyLASIK- Excimer Laser- Correction of Presbyopia.

Acknowledgement

First of all, I would like to thank ALLAH, the most gracious and the most merciful for his Infinite blessings.

I would to express my real and deepest gratitude, respect and appreciation to Professor Dr. Mahmoud Abou Steit, Professor of Ophthalmology, Cairo University, for his valuable advice, continuous support, scientific addition and sincere help throughout the work.

My profound thanks and appreciation to Professor Dr. Amr ELBakry, Professor of Ophthalmology, Cairo University, for his fruitful suggestions and valuable advice.

Special thanks to Dr. Tarek AlNaggar, Lecturer of Ophthalmology, Research Institute of Ophthalmology, for his great effort and continuous encouragement.

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

Mohamed Beshr

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List of Abbreviations

ACS: Anterior Ciliary Sclerotomy

AMO: Advanced Medical Optics

ArF: Argon Flouride

CDVA: Corrected Distance Visual Acuity

CK: Conductive Keratoplasty

CNVA: Corrected Near Visual Acuity

D: Dioptre

FDA: Food and Drug Administration

HOA: High Order Aberration

IOL: Intraocular lens

IOP: Intraocular Pressure

J: Jeager

LASIK: Laser Assisted Insitu Keratomileusis

MAR: Minimum Angle of Resolution

Nd YAG: Neodymium Yttrium-Aluminium-Garnet

OZ: Optical Zone

PAC: Pseudoaccommodative Cornea

PCO: Posterior Capsule Opacification

PML: Presbyopia Multifocal LASIK

PMMA: Polymethylmethacrylate

PRELEX: Presbyopic Lens Exchange

PresbyLASIK: Presbyopia laser in situ Keraomileusis

PRK: Photorefractive Keratectomy

PTK: Phototherapeutic Keratectomy

Q: Quotient of asphericity

RD: Retinal Detachment

SA: Spherical Aberration

SEB: Scleral Expansion Band

UDVA: Uncorrected Distance Visual Acuity

UNVA: Uncorrected Near Visual Acuity

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INTRODUCTION

Historically, the cornea has been the focal point of the refractive surgeon because of its anatomic accessibility. Professor Jose Ignacio Barraquer, considered by many to be the godfather of modern refractive surgery. His influence on refractive surgery and ophthalmology will undoubtedly be felt far into the coming millennium. Dr Steven Trokel, an innovative ophthalmologist, began to experiment with the excimer laser and in 1983 published the first article describing excimer laser surgery of the cornea. Initially considered to be a tool to make precision radial cuts in the cornea, its application would be modified to reshape the corneal stroma, and, along with it, the entire field of ophthalmology.[1]

Since the first report by Trokel in 1983 describing the use of the excimer laser to achieve precise etching of the cornea, the photoablative property of the excimer laser has had two primary clinical applications: phototherapeutic keratectomy (PTK) and several types of photorefractive keratectomy (PRK).[2]

Initially described by Pallikaris et al in 1990, laser in situ keratomileusis (LASIK) is an increasingly popular technique for correcting refractive errors. It involves the excimer laser ablation of corneal stroma beneath a hinged corneal flap that is created with a microkeratome.[3]

Basic Excimer Laser Concepts and Corneal Refractive Surgery

The excimer laser (Excited Dimer) consists of three vital components: the lasing medium, the lasing cavity, and the optical delivery system. ***(Flowers et al 2001).***

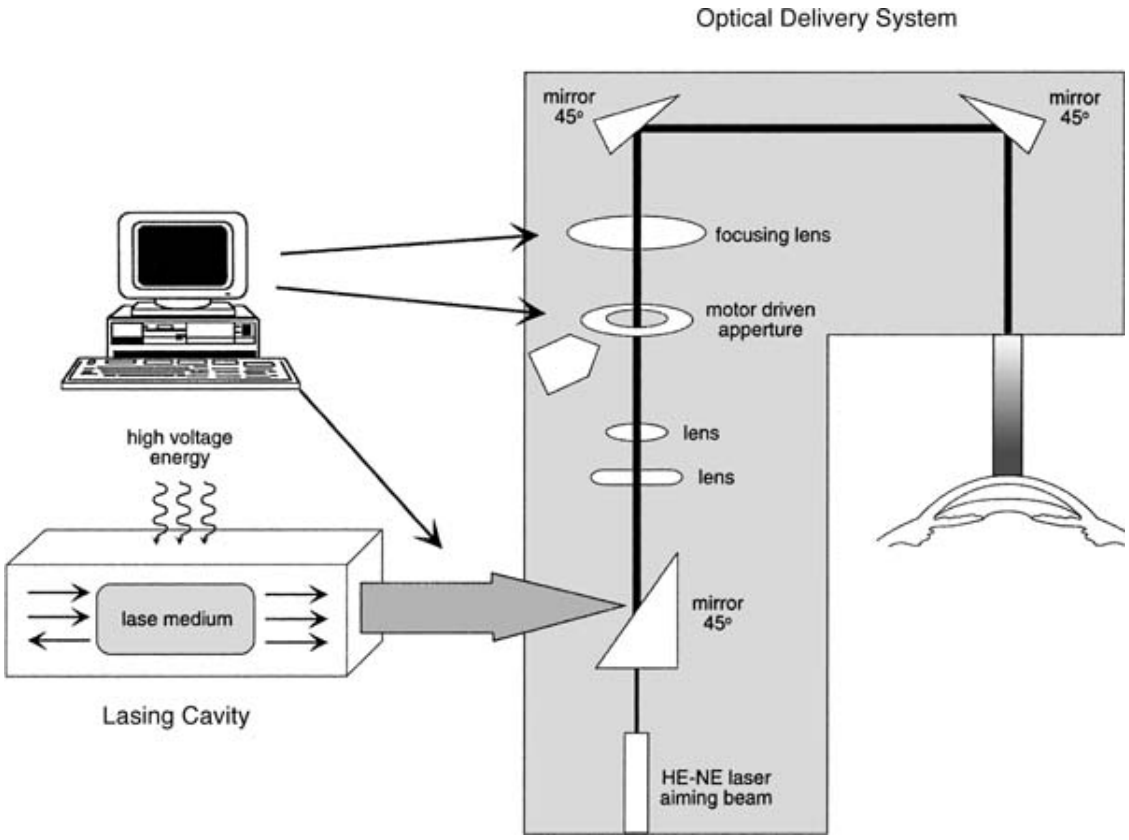

Figure 1: An excimer laser system. The computer controls the magnitude and pattern distribution of laser energy delivered to the cornea and the diameter of the laser aperture. The optical elements are designed and configured to remove laser beam in homogeneities. *(Flowers et al 2001).*

The lasing medium is composed of an Argon Fluorine gas mixture, which on excitation emits electromagnetic radiation in the far-ultraviolet region of the spectrum (193-nm wavelength). By design, only those emitted photons that possess the same phase relationship (i.e. coherence) are allowed to pass out of the lasing cavity and into the optical delivery system, which consists of a complex series of lenses, prisms, mirrors, and apertures. The radiation produced by the excimer laser is inherently inhomogeneous and unsuitable for ophthalmic applications. Therefore, the optical delivery system is specifically designed to convert the excimer laser radiation into a homogeneous beam of light capable of removing tissue with submicron precision.[4]

The major advantage of ArF-excimer lasers for photorefractive surgery compared with other techniques for tissue removal is the sub-micron precision obtained by photoablation.[5]

PresbyLASIK treatment uses the principles of LASIK surgery to create a multifocal corneal surface aimed at reducing near vision spectacle dependence in presbyopic patients.

There are two main different techniques for presbyLASIK treatment. In the first technique, known as central presbyLASIK, a central area is created for near vision and a peripheral area is created for distant vision.

Whereas in the second technique, known as peripheral presbyLASIK, the central area is for distant vision and the mid-peripheral area is for near vision. Both techniques create a multifocal pseudoaccommodative corneal surface. One of the advantages of this type of treatment is that it is centered on the visual axis of the eye rather than on the corneal apex, like many multifocal contact lenses and in this way decreases the induced loss of optical performance due to axis mismatching.

Other advantages of corneal multifocal surgery are the accessibility of corneal refractive surgery for patients, its less invasive character than intraocular surgery, and its attractive appearance to patients.

AIM OF THE WORK

The aim of the thesis is to study the effect of central PresbyLASIK, using PRESBYMAX software, as a new modality for the treatment of presbyopia.

REVIEW OF LITERATURE

ACCOMODATION

By "accommodation" is understood the change of the eye's optical power to facilitate focusing on objects at different distances. Hermann von Helmholtz whose description of the accommodative mechanism from the year 1855 is still valid in all major parts wrote in his *Handbook of Physiological Optics*: "There is no other portion of physiological optics where one finds so many differing and contradictory ideas as concerns the accommodation of the eye where only recently in the most recent time have we actually made observations where previously everything was left to the play of hypotheses[6]". Even nowadays, the mechanism of accommodation and the cause of presbyopia are a matter of controversial discussion, and a general consensus comprising all the elements has not yet been reached.

THE MECHANISM OF ACCOMMODATION

Anatomy of the Accommodative Apparatus:

Ciliary Muscle:

The accommodative plant of the eye contains the ciliary body, the ciliary muscle, the anterior and posterior zonular fibers, and the lens, which consists of the lens capsule and the lens substance. The ciliary muscle is located within the ciliary body and consists of three groups of muscular fibers which are distinguished by their situation and ordering within the ciliary body[7]. These groups are the longitudinal, the radial, and the equatorial or circular fibers.

The longitudinal part of the muscle borders directly to the sclera. Farther inward of the longitudinal part are the radial fibers and, farthest anterior and

inward, the circular fibers. Anteriorly, the ciliary muscle inserts at the scleral spur and the trabecular meshwork. Posteriorly, it is fixed by elastic tendons to the stroma of the choroid.

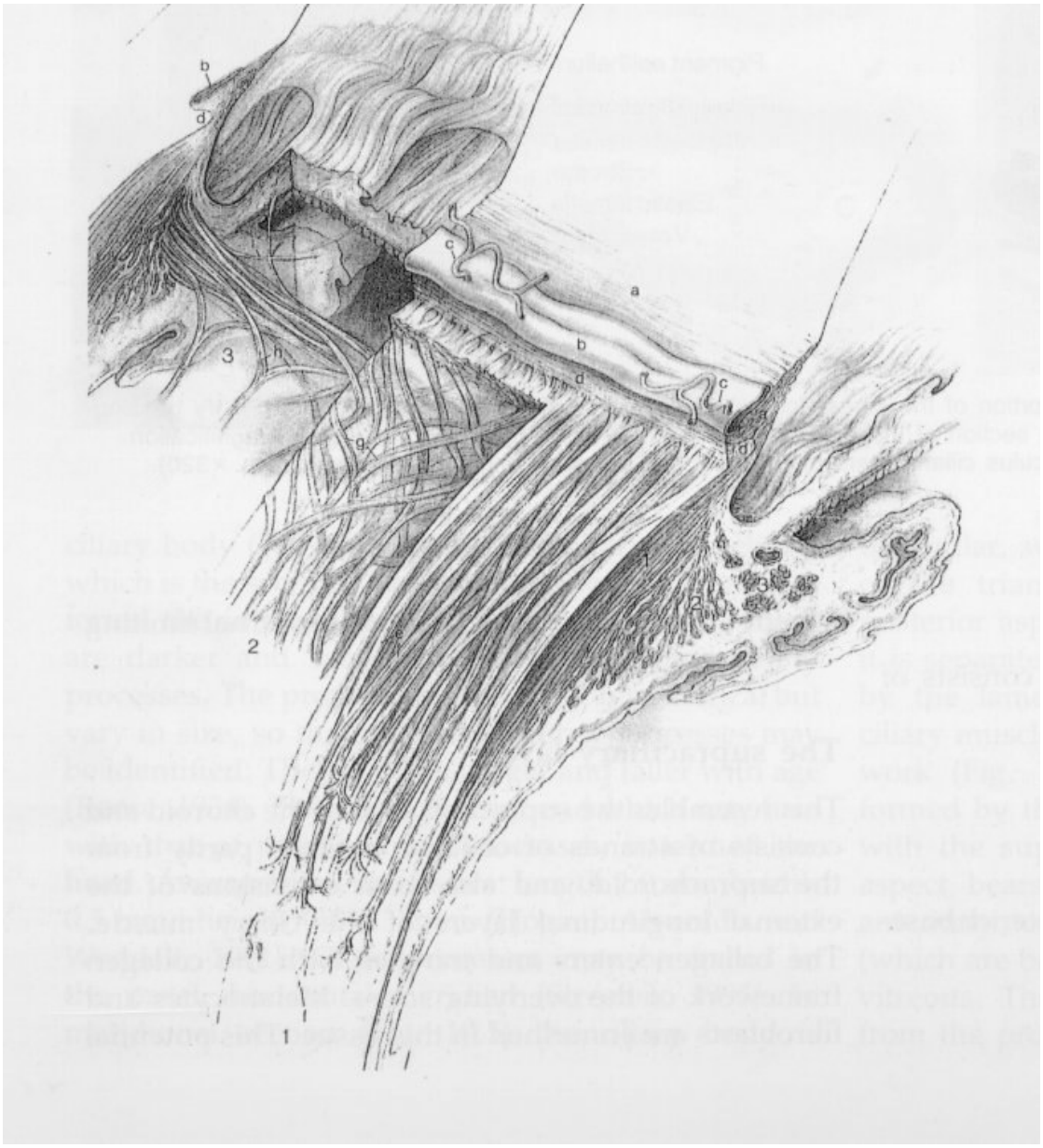

Figure 2 Drawing of the ciliary body showing the ciliary muscle and its components a)trabecular meshwork b)Schlemm's canal c)two external collectors d)scleral spur e)longitudinal muscle g)radial muscle (Bron et al., 1997).

Zonular Fibers:

The zonule consists of fine elastic fibers which can be grouped by localization, origin, and insertion into two groups (posterior and anterior). The