Corneal flap advances in Lasik

Essay

Submitted For Partial Fulfillment of Master Degree of Ophthalmology

Presented by

Sameh Younis El-kashishi

M.B. B.Ch.

Supervised by

Professor Doctor Fikry F. Zaher

Professor of ophthalmology

Ain Shams University

Doctor Maged M. Salib

Lecturer of ophthalmology

Ain Shams University

Faculty of medicine

Ain Shams University

Cairo, Egypt

2010

ACKNOWLEDGMENT

MY ENDLESS AND EVERLASTING THANKS TO GOD

Although no words can express my great gratitude and respect to **Prof. Dr. Fikry Zaher** Professor of ophthalmology, Ain Shms university, I would like to thank him for his encouragement, advice and his great sincere support throughout this study.

I feel greatly indebted to **Dr. Magid Maher Salib**, lecturer of ophthalmology, for his great care, patience, sincere guidance, tremendous effort and valuable advice throughout this study.

Finally, no words will be enough to express my sincere gratitude and appreciation to every member in my family. Without their support, love; this work would never have been accomplished.

List of abbreviations

ACS	Automated Corneal Shaper.
ArF	Argon Fluoride.
ASA	Advanced Surface Ablation
BCVA	Best Corrected Visual Acuity
BSS	Balanced Saline Solution
BMP	Bone Morphogenic Proteins
CB	Carriazo-Barraquer.
CHOAs	Coneal Higher Order Aberrations
cpd	Cycle Per Degree
DLK	Diffuse Lamellar Keratitis
EGF	Epithelial Growth Factor
eV	Electron Volt.
FLEx	Femtosecond Lenticular Extraction

FS laser	Femtosecond Laser.
GAPP	Good Acuity Plus Photosensitivity
IL	Interlukin
KrF	Krypton Fluoride.
LCA	Low Contrast Acuity.
LASEK	Laser Sub Epithelial Keratomelieusis
LASIK	LAser in Situ Keratomelieusis
MCAF	Monocyte Chemotactic and Activating Factor
MRSE	Manifest Refraction Spherical Equivalent
ND: YAG	Neodymium- Yttrium Aluminum-Garnet
ND: YLF	Neodymium: Yttrium Lithium Fluoride
OBL	Opaque Bubble Layer
PDGF	Platelet Dervid Growth Factor
PRK	Photorefractive Keratectomy
PTK	Phototherapeutic keratectomy

Rpm	Revolutions per minute
RST	Residual Stromal Thickness
SBK	Sub-Bowman Keratomileuisis
SD	Standard Deviation.
SE	Spherical Equivalent
SEMs	Scanning Electron Micrographs
SKBM	Summit Krumeich-Barraquer Microkeratome
TLS	Transient light sensitivity
TNF	Tumor Necrosis Factor
UCVA	Uncorrected Visual Acuity
Vs	Versus

List of figures

List of tables

Contents

Introduction

Laser In situ Keratomileusis (LASIK) is currently the refractive surgery procedure of choice for most patients with low to moderate refractive errors. LASIK has gained this acceptance because of minimal discomfort and rapid visual recovery with good long-term results and stability of refractive effect. **(Leaming, 2004)**

The era of Keratomileusis began in 1966 with **Pureskin**, who demonstrated that refractive changes could be achieved by creating a corneal flap and removing central tissue in a lamellar fashion under the flap. He found that the smaller the diameter of the resected disc, the greater the refractive changes. **(Taravella, 2009)**

Between 1983 and 1988, **Luis Ruiz** and **Rowsey**, proposed the"in situ"technique. The refractive keratectomy was done directly on the cornea, instead of the cap. The microkeratome sliced the central part of the remaining stroma and stroma lenticule was removed**. (Ruiz and Rowsey, 1988)**

In 1993, **Steve Slade** added the refinement of using an automated microkeratome to create the flap. **(Taravella, 2009)**

Current microkeratome systems are limited in their ability to create flaps in eyes with different corneal and/or orbital configuration. The flap complications associated with microkeratomes include decentered and free flaps, irregular edges and surfaces (chattering), epithelial abrasion, buttonhole perforation, cap lacerations, and inadequate diameter for a given correction. Most systems are limited to producing a single hinge location and create hinge sizes that are highly variable. For some refractive errors, it is necessary to decenter the flap, but current microkeratomes systems don't allow predictable decentrations.

Most systems produce meniscus flap shapes that are thinner in the centers and thicker towards the periphery, which increases the risk for a buttonhole perforation. Preoperative thin and/or steep corneas can limit the use of most systems because thin and steep corneas create thinner than predicted flap.

Precisely cut corneal flaps are essential for successful Lasik treatments and calculation of ablation profiles. Even with modern mechanical microkeratomes, variation in flap thickness and morphology can be found. Differences in flap thickness can be related to several factors, including the microkeratomes model used. However many complications of Lasik surgery are still related to the flap-cutting process. An alternative way of producing Lasik flaps involves modern lasers that are based on the femtosecond laser technology**. (Holzer et al., 2006**)

There are mechanical and Femtosecond laser microkeratomes. The later is a solid state laser used to create flap using infrared light with wavelength 1053 nm to deliver closely spaced 3μm spots that can be focused to a preset depth to photo disrupt tissue stroma. **(Kezirian and Stonecipher, 2004)**

Intralase (a femtosecond laser microkeratomes) provides the highest degree of precision and uniformity. Intralases micron-level precision creates significantly more predictable and accurate flap dimensions, including, most critically, reproducible flap thickness, within ten micrometer, whereas variability with microkeratomes has been reported up to 40 micrometer. This increased precision preserves variable corneal tissue and improve the predictability of the Lasik treatment. **(Ming, 2006)**

Aim of the work

The aim of this work is to compare between recent trends in making corneal flaps in Lasik and demostrate which flap is best, regarding the morphology, cut accuracy and histopathology.

Anatomy of the cornea

Refractive surgical procedures work by altering corneal anatomy to create a new shape; flatter in the center with a steeper periphery. The incision severs a graded amount of corneal stroma, allowing the biomechanical forces to produce a gaping of incisions and repositioning of the uncut corneal tissues. **(Warring et al., 1998)**

Wound healing holds this new corneal contour, but the wounds are not as strong as the original uncut cornea. If this surgery was carried out on the homogenous material of known physical properties, such as steel or plastic, the surgeon could accurately predict the surgical outcome. However, the cornea has a non-homogenous structure that undergoes not only acute changes in the shape immediately after it is incised, but also slower changes in shape because of its viscoelastic properties and the process of wound healing. **(Warring et al., 1998)**

One can consider the cornea fancifully as a sandwich dipped in nutritious soup. Two surface layers, the epithelium and the endothelium, contain a central filling, the stroma. All three layers receive nourishment and oxygen from tears, aqueous humor, limbic vessels. More precisely the structure of cornea fits that of many other tissues. The surface epithelium and endothelium rests on basement membrane (The epithelial basement membrane and