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شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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Comparison between Small Incision Lenticule Extraction and Wavefront-Guided Femtosecond Laser-Assisted In Situ Keratomileusis in Correction of Myopic Astigmatism

Thesis

Submitted for partial fulfillment of Master degree in Ophthalmology

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List of Abbreviations

Abbrev.		Full term
AS-OCT	:	Anterior segment optical coherence tomography
CDVA	:	Corrected distance visual acuity
CI	:	Correction index
DV	:	Deviation vector
FLEX	:	Femtosecond lenticule extraction
FSL	:	Femtosecond laser
FS-LASIK	:	Femtosecond laser assisted LASIK
HOAs	:	Higher order aberrations
LASIK	:	Laser assisted in situ keratomileusis
MRSE	:	Manifest refractive spherical equivalent
PRK	:	Photorefractive keratectomy
ReLEx	:	Refractive lenticule extraction
RMS	:	Root mean square
SIA	:	Surgically induced astigmatism
SMILE	:	Small incision lenticule extraction
TIA	:	Target induced astigmatism
UDVA	:	Uncorrected distance visual acuity
WFG	:	Wavefront guided
WFO	:	Wavefront optimized

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Introduction

Refractive surgery, both corneal and intraocular, had undergone a remarkable evolution during the last 25 years. The first excimer laser surgery performed over 25 years ago was a historical landmark which started the era of corneal refractive surgery.(1)

The introduction of excimer laser in practice of refractive surgery was an exciting innovation. Almost everything that could be known about efficacy, predictability and stability, complications, technological development and innovation was then reported and accomplished in over two decades. (2)

Corneal refractive surgery performed by excimer laser has matured considerably and was able to cover from +6 to −12 diopters of sphere and up to 6 diopters of astigmatism with good, predictable and safe outcomes. (3)(4)

Femtosecond corneal surgery is one of the most outstanding innovations in the field of refractive surgery. Recently, refractive lenticule extraction (ReLEx) has been

introduced as a single laser refractive procedure (all-in-one femtosecond procedure) without the use of an excimer laser.[5]

Small incision lenticule extraction (SMILE) is a variation of ReLEx which requires no retractable flap so reducing the incidence of flap complications, dry eye, reducing the surgical time and patient discomfort through operating on only one device in addition to decreasing the risk of ectasia. [6]

Aim of the Work

To compare visual acuity, refractive and topographic outcome between small incision lenticule extraction (SMILE) and wavefront-guided femtosecond laser-assisted in situ keratomileusis (WFG FS-LASIK) in patients with myopic astigmatism.

Review of Literature

The excimer laser

The word excimer is derived from excited dimer, to describe an energized molecule with two components. Laser is short for light amplification by stimulated emission of radiation, a technique derived from microwave amplifying devices (masers) in the late 1950s [(7)]. The excimer laser is an ultraviolet laser combining a noble gas (Argon) with a reactive halogen gas (Fluoride). It emits photons at a wavelength of 193 nm which can break the peptide backbone and vaporize corneal collagen molecules in a process called ablative photodecomposition. This was first described and introduced in refractive surgery by Trokel et al. [(8)]. The laser has high corneal absorption and low tissue penetration and can ablate corneal tissue without significantly heating or damaging the adjacent tissue because of the short pulse duration.

The excimer laser energy can generally be delivered with three different types of lasers. Broad-beam lasers were used in the first-generation laser platforms. They used a full laser beam with internal masks or diaphragms for customized ablations, but the ablation plume sometimes resulted in untreated areas, so-called central islands [(9)(10)]. Scanning-slit lasers used a smaller slit-shaped laser beam capable of rotation and were able to treat larger-diameter ablation zones. Today, most modern excimer lasers are flying-spot lasers [(11)] with eye

trackers [12], allowing for more complex treatments such as topography or wavefront-guided treatments. They use small circular laser spots at high frequency and sufficiently spaced to avoid thermal effects. Overall, laser pulse frequency, energy and duration are important parameters to avoid slow treatment, thermal effects and variation in the laser ablation effect. The amount of laser energy per unit of area needed for corneal photoablation is approximately 50mJ/cm^2, and subthreshold fluence can cause irregular and incomplete ablation. Furthermore, corneal hydration affects ablation rate, hence, dehydration increases ablation rate and vice versa. [7]

Laser-assisted in situ keratomileusis

Laser-assisted in situ keratomileusis (LASIK) was first used in 1990 by Pallikaris, in which a microkeratome was used to cut a hinged corneal flap, followed by excimer ablation of the stromal bed and flap repositioning. [13][14] LASIK has now become the most common elective surgical procedure in the world, presumably because it is an almost painless surgical procedure with fast visual recovery, as compared to Photorefractive keratectomy (PRK). [15] These advantages have been documented in several reviews comparing PRK and LASIK, but they have also underlined that accuracy and safety were very similar in the two techniques for treatment of low to moderate myopia and when contemporary techniques such as wavefront-guided treatments and FSL flap creation were used.[16]