Applications of Femtosecond Laser in Corneal and Refractive Surgery

Essay
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تطبيقات ليزر الفيمتو ثانية في جراحات القرنية و تصحيح الأخطاء الإنكسارية

رسالة
توطئة للحصول على درجة الماجستير
فى طب وجراحة العيون

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ABBREVIATIONS

AC: anterior chamber

AK: astigmatic keratotomy

AL: applanation lens

ALK: anterior lamellar keratoplasty

AMO: Advanced Medical Optics

BCVA: best corrected visual acuity

BDD: beam delivery device

BSCVA: best spectacle corrected visual acuity

CCT: central corneal thickness

CL: contact lens

CPD: cycle per degree

CQ: clinical quality

CS: Contrast sensitivity

CXL: Collagen Cross-linking

D: dioptre

DALK: deep anterior lamellar keratoplasty

DIC: differential interference contrast

DLEK: deep lamellar endothelial keratoplasty

DLK: diffuse lamellar keratitis

DSAEK: Descemet stripping automated endothelial keratoplasty

DSEK: Descemet stripping endothelial keratoplasty

EK: endothelial keratoplasty

FDA: Food and Drug Administration

FLEX: femtosecond lenticule extraction

FLK: femtosecond laser keratomileusis

FS: femtosecond

FSL: femtosecond laser

HOAs: high order aberrations

ICRS: Intrastromal corneal ring segments

IOLs: intraocular lenses

IOP: intraocular pressure

IRIS: Intra-tissue Refractive Index Shaping

J: joul

KHz: kilo hertz

KP: keratoplasty

LAR: laser arcuate wedge shaped resection

LASIK: laser in situ keratomileusis

LIOB: laser induced optical breakdown

LK: lamellar keratoplasty

mJ: milli joule

MHz: mega hertz

MK: microkeratome

mm: millimeter

n: nano

Nd: neodymium-doped

Nd: YAG: neodymium-doped yttrium aluminium garnet

Nd: YLF: neodymium-doped yttrium lithium fluoride

nJ: nanojoul

nm: nanometer

ns: nanosecond

OBL: opaque bubble layer

OCT: optical coherence tomography

PCT: peripheral corneal thickness

PK: penetrating keratoplasty

PLD: posterior lamellar disc

PLK: posterior lamellar keratoplasty

PMCD: Pellucid marginal corneal degeneration

PMMA: poly methyl methacrylate

PRK: photorefractive keratectomy

ps: picoseconds

RI: refractive index

S: second

SBK: Sub-Bowman's Keratomileusis

SD: standard deviation

SEM: scanning electron microscope

SMILE: Small-Incision Lenticule Extraction

SRA: suction ring assembly

TLSS: transient light sensitivity syndrome

µ: micron

UCVA: uncorrected visual acuity

µJ: microjoul

µm: micrometer

US: United States

VA: visual acuity

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Introduction

Femto- (symbol **f**) is a prefix in the metric system denoting a factor of 10^{-15} or 0.000000000000001. Adopted by the 11th *Conférence Générale des Poids et Mesures*, it was added in 1964 to the *SI* (***S**ystème **i**nternational d'unités*). It is derived from the Danish word *femten*, meaning "fifteen". While Ahmad H. Zwail the famous Egyptian scientist, won the Noble prize in 1999 for his work on femtochemistry. **(Wikipedia online)**

The development of the Ruby laser almost a half-century ago by T. H. Maiman was an epiphany that opened up wide new vistas in ophthalmology, resulting in a flood of practical clinical applications of lasers in eye surgery **(Soong and Malata, 2009).**

Ultra short pulse generation remains the subject of active research. Rapid progress in this field has led to the creation of practical and useful lasers that can now produce pulses on the femtosecond FS (10^{-15} s) time scale **(Wayne and Knox, 2000)**