Refractive Surgery

**Damian B. Lake**
MB.ChB.FRCOpht.
Consultant Ophthalmic Surgeon
The Corneo Plastic Unit and Eye Bank, East Grinstead and
Centre for Sight
Lakedamian@hotmail.com

---

Refractive Surgery

- “Any operation intended to alter the refractive state of the eye”

---

The Normal Eye

Similar in function to a Camera
What influences Focus?

FARSIGHTED Eye (Hyperopia)
Focal Point of Eye outside Retina

REASONS
Eye too SHORT
Cornea too FLAT

VISION
Distance: Clear
Near: Poor
Older = BOTH
Distance & Near poor

NEAR or SHORTSIGHTED Eye (Myopia)
Focal Point of Eye short of Retina

REASONS
Cornea too CURVED
Eye too LONG

VISION
Distance: Blurred
Near: Clear
ASTIGMATISM
• TWO Focal Points

VISION
• Distance: Poor
• Near: Poor
• Distorted

OVAL Cornea

Presbyopia “old eye”
• - age 40 and above
• - natural
• - mechanism

Laser Vision Correction
Re sculptures the Cornea
What if I am unsuitable for laser vision correction?

CORRECTION – PHAKIC LENS

- IMPLANTABLE CONTACT LENS

CORRECTION-PHAKIC LENS

- ARTISAN/ARTIFLEX
Clear lens extraction

Refractive surgery

- What are the options otherwise?

Refractive surgery

- Why have Refractive surgery?
Refractive surgery

• Why have Refractive surgery?

Occupational

Refractive surgery

Spectacle
Aesthetics

Refractive Surgery

Convenience and Cost
Refractive surgery

- But contact lenses are risk free?

Aren't they?

Refractive surgery

Corneal based
- Incisional
  1. RK
- Laser
  1. LASIK
  2. LASEK/PRK

Refractive surgery

Lens based
- Phakic IOL
- Refractive Lens Exchange
Refractive Surgery

Corneal Based
- Incisional-Radial Keratotomy
- Laser
  1. Surface-PRK/LASEK
  2. Under a flap-LASIK

Refractive Surgery

- Radial keratotomy complications
  - Optical
  - Related to wounds
  - Refractive irregularity
  - Sight threatening

Refractive Surgery

- Radial Keratotomy Negligent treatment
  - Performing it at all!
Refractive Surgery

**Corneal Based**
- Incisional-RK
- Laser
  1. Surface-PRK/LASEK
  2. Under a flap-LASIK

---

Refractive Surgery

- LASEK/PRK
- No flap Laser
- Surface Laser
- More painful
- Healing longer

---

LASEK
Refractive Surgery

• LASEK/PRK contraindications
• Patient expectation
• Cornea factors
• Systemic Factors

Refractive Surgery

• LASEK/PRK consent issues
• Increased risk of infection
• Haze formation
• Mitomycin C use
• Healing response

Refractive Surgery

• LASEK/PRK Complications
• Haze
• Delayed surface healing
• Infection
• Risks of steroids
Infection after PRK

Delayed healing after PRK

Haze after PRK
Refractive Surgery

**Corneal Based**
- Incisional-RK
- Laser
  1. Surface-PRK/LASEK
  2. Under a flap- LASIK

---

Refractive Surgery

- LASIK
  - “Flap and Zap”
  - Less pain
  - Quick Rehabilitation
  - Over 20 million procedures worldwide

---

Refractive Surgery

- LASIK flap creation

Blade versus Laser
LASIK-microkeratome blade

- Complications
- Suction loss
- Button hole
- Free cap
- Too deep

Microkeratome blade

Microkeratome LASIK

“Meniscus shaped”
Target 160µm
Refractive Surgery

• LASIK Complications
  • Flap
  • Optical
  • Dry eye
  • Ectasia
  • Infection
  • “Readers”
  • Glare

Refractive Surgery

• LASIK contraindications
  • Patient factors
  • Ocular factors
  • Systemic factors

Refractive Surgery

• LASIK-Patient safety devices
  • Screening
  • No blades-IntraLASIK
  • Iris recognition
  • Eye tracking
  • Wavefront treatments
  • Early recognition by Doctors
IntraLASIK

“Planar” shape
Target 90µm

Femtosecond laser

For flap creation
Increased cost but increased patient safety!

Refractive Surgery

Wrinkles in LASIK flap
Sands of the Sahara After LASIK

Infection under LASIK flap

Epithelial ingrowth after LASIK
LASIK

Flap lifted and Cornea reshaped

LASIK

Excimer laser accuracy on human hair

LIMITATIONS of IntraLASIK

OPTIC ZONE SIZE - Determinants
PUPIL SIZE - scotopic
CORNEAL THICKNESS

Small pupil
Large pupil
Deeper Ablation
Refractive Surgery

- Ectasia
  - Cornea too thin
  - Structurally weak
  - Too much laser

Ectasia Treatment

Intacs

Abberations

How can we measure and treat this?
Aberrations

Before repair

After repair

Hubble space telescope

Wavefront Principle

A narrow laser beam is focused on the retina to generate a point source.

Wavefront Principle

The outcoming light rays experience all aberrations and their deviation is detected by an array of lenses.
Wavefront Principle

Example of a measured signal (centroids) giving the possibility to reconstruct the wavefront

Wavefront treatment

Wavefront treatment
Corneal Laser Surgery

- Consent issues
- Advertising
- Language
- Additions to consent
- Talk to surgeon
- Time to consent
- Documentation

Good results
- Small risk of complications
- Most complications easily treated
- Long term complications rare

Refractive surgery - Lens based

- Cataract surgery
- Refractive lens exchange (RLE)
- Adding an extra lens - Phakic IOL
Refractive Surgery

- Why have lens surgery?
- Short sighted
- Long sighted
- Astigmatism
- Presbyopia

Presbyopia

Ciliary Muscle

Images courtesy of Susan A.
Correction - lens replacement

Crystalens HD

Correction - Lens replacement

ZEISS MULTIFOCAL LENS

Multifocal lens

Rings
Refractive Lens Exchange

- Complications
- New lens factors
- Surgical risks
- Related to natural lens removal

Retinal Detachment

Risk 1.5-8.1%

Forceps mark
Refractive Lens Exchange

- Consent issues
- Alternatives
- Risks
- Retinal detachment
- Long term effects

Phakic IOL

- Consent issues
- Patient factors
- Ocular factors
- Long term follow up
- Young people
Implantable Contact Lens (ICL)

- Implanted without removing natural lens

- Complications
  - Incorrect sizing
  - Infection
  - Inflammation
  - Glaucoma

- Laser iridotomy
Implantable Contact Lens (ICL)

Cataract

Acute Glaucoma

Artisan Lens

Attached to iris

Implanted without removing natural lens
Artisan Lens

- Phakic IOL complications
- Inflammation
- Infection
- Dislocation
- Cornea clouding
- Glaucoma

Summary

- Laser Refractive surgery
- High satisfaction rates
- Low complications
- Low morbidity

Summary

- Refractive lens exchange
- Risks higher
- Rarely sight threatening
- Increased in High Street chains