

Refractive & Cataract Update Part 2

Multifocal & Accommodative Implants

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Accommodating & Multifocal Lenses

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Historical Perspective - IOL

- Mid 18th Century – Tadini – concept of IOL¹
- 1795 – Casaamata (Dresden)² – implanted a glass implant - displaced posteriorly
- 1949 Sir Harold Ridley - first IOL at St Thomas's Hospital, London



1. Fechner PU, Fechner MU. J Am Intraocul Implant Soc. 1979 Jan;5(1):22-3. Tadini, the man who invented the artificial lens
2. Henning A Gesnerus. 1990;47 Pt 1:95-104. From Tadini to Svyatoslav N. Fedorov. Difficulties of ophthalmologic surgery.

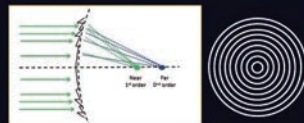
Sir Harold Ridley (1906-2001) CENTRE FOR SIGHT

Multifocal Lenses

Multifocal **refractive** optic
→ Juxtaposition of zones with different powers

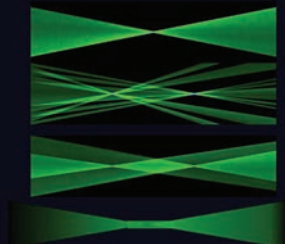


Multifocal **diffractive** optic
→ Fresnel system diffracting the light rays to different foci



Premium Lens Categories

- ACCOMMODATIVE
– Crystallens
- ZONAL REFRACTIVE
– Array, Rezoom
- DIFFRACTIVE
– Restor, Tecnis
- EXTENDED DEPTH of FOCUS
– Symphony, WIOL



Ideal Lens

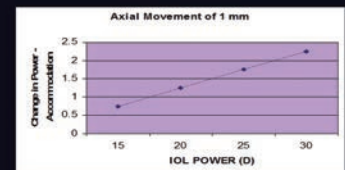
- 100% - energy at focal point
- Is it necessary?
 - How much energy is reduced by cataract?
 - Reality: 100% not required
 - Distance vision – requires more energy
 - Intermediate & Near = less



Accommodative Lens Amplitude of Accommodation

Ray Tracing

- proportional to:
 1. Power of Lens
 2. Amount of Movement
- $$\Delta D_c = (D_m / 13) \Delta s$$
- D_c = conjugation power
 D_m = Dioptic power of lens



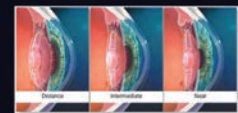
Accommodative Lenses

- FLEXIBLE
 - Crystallens (Eyeonics/ Bausch & Lomb)
 - 5-0
 - HD
 - 1CU Accommodative Lens (Human Optics)
 - Tetraflex (Lenstec)
 - Synchrony



Crystallens' mechanism of action for accommodation

- It has two mechanisms of action:
 1. **VAULTING**
 - FORWARD axial movement of the lens =
 2. **ACCOMMODATIVE ARCHING**
 - The secondary mechanism
 - flexing or arching of the optic,

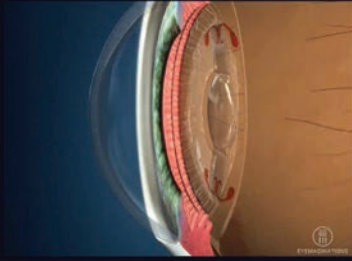


'Multifocal & Accommodative Implants'

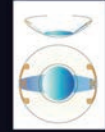
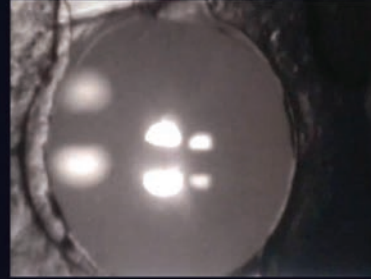
(slides 1-8)

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Does the Crystallens move ?

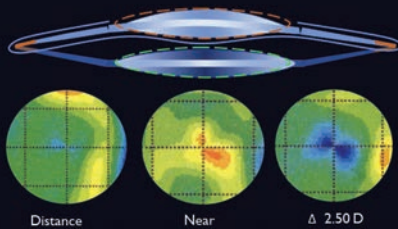
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Crystallens in-vivo movement

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OPTICAL ARCHING

Capsular contraction slightly distorts the optic as it is forced anteriorly, changing the radius of the lens.
Central power INCREASES

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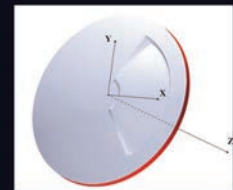
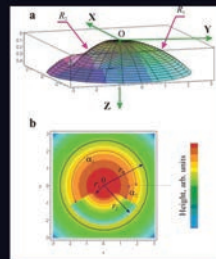
Zonal Refractive Lens

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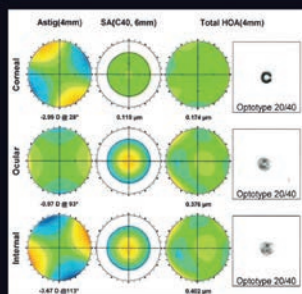
Oculentis M-Plus

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Like a bifocal

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M plus - COMA & Aberrations

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Night Vision

Night Vision

- 17% spontaneously report glare at night
- 10% difficulty in driving – “glare goes to the road”

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‘Multifocal & Accommodative Implants’

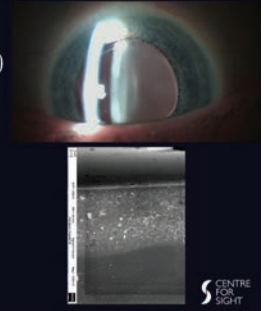
(slides 9-24)

M Plus – upside down



M Plus Problems

- Visual problems
 - Poor quality vision (like being in a fishbowl)
 - Unreliable near vision
- Personal series:
 - 248 implanted – 6 removed !
- Many others removed from elsewhere
 - Visual problems
 - Opacification



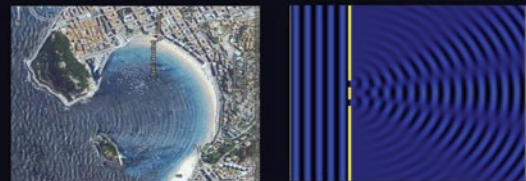
Trifocal Diffractive Lenses

- FINEvision – Physiol
- AT LISA Tri – Zeiss
- Rayner
- Artis
- Panoptix - Alcon

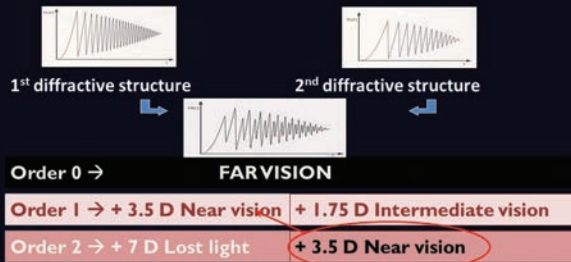
DIFFRACTION

Huygens-Fresnel principle:

the plane wave is transformed into an infinity of secondary spherical waves after diffraction. The orders of diffraction are the harmonics of propagation



COMBINATION OF TWO DIFFRACTIVE STRUCTURES



Energy gain harnessed for near Intermediate vision & maintains far and near vision

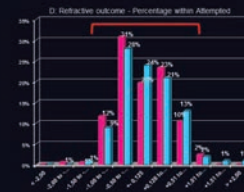
PREDICTABILITY 1 Month

Number of eyes 1 m: 184 (77.7%)

SE: $0.01 \text{ D} \pm 0.48 \text{ D}$ (range -1.50 to 1.25)

CYL: $-0.39 \text{ D} \pm 0.40 \text{ D}^\circ$ (range -2.25 to 0.00)

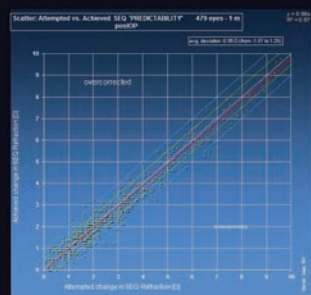
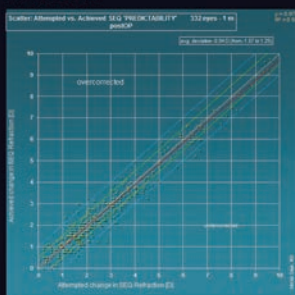
95% WITHIN 1.00D



Predictability

MANUAL

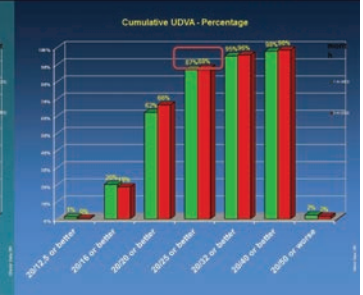
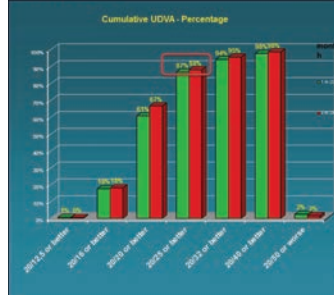
FEMTO

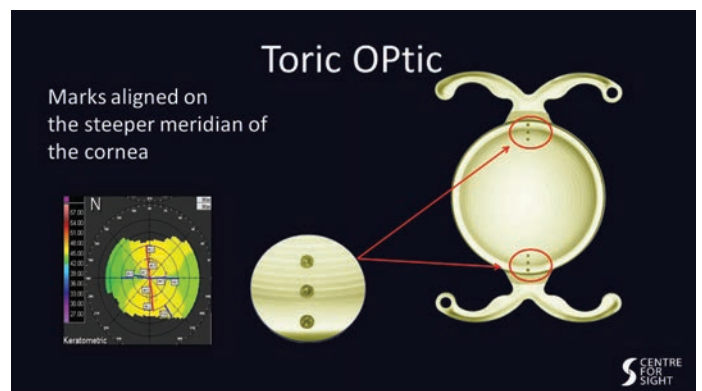
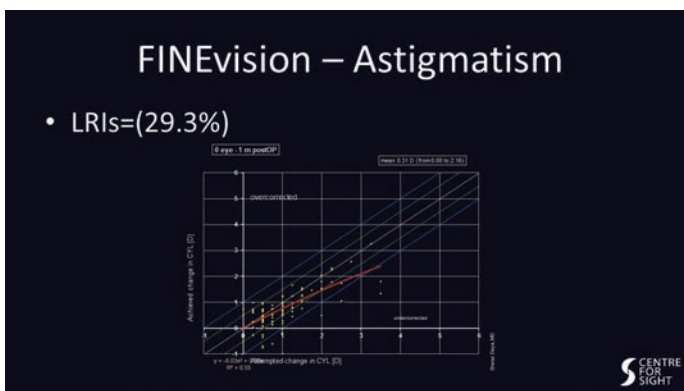
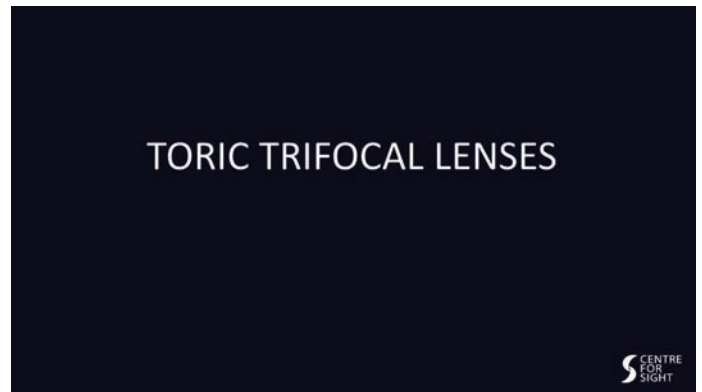
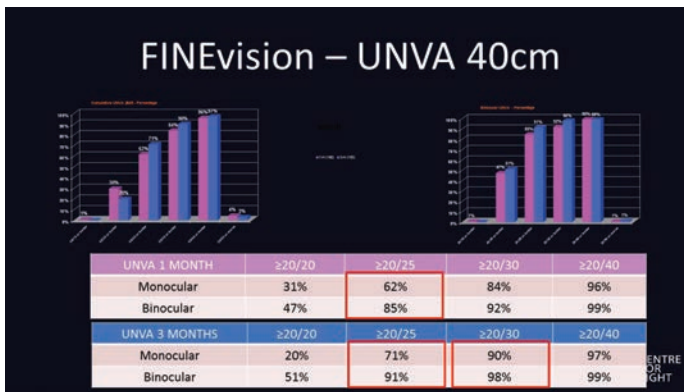
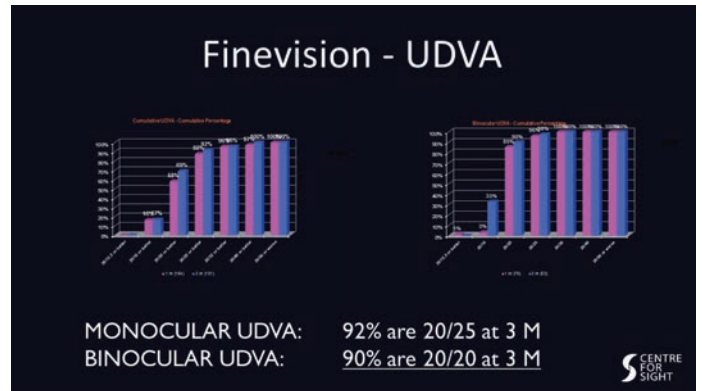
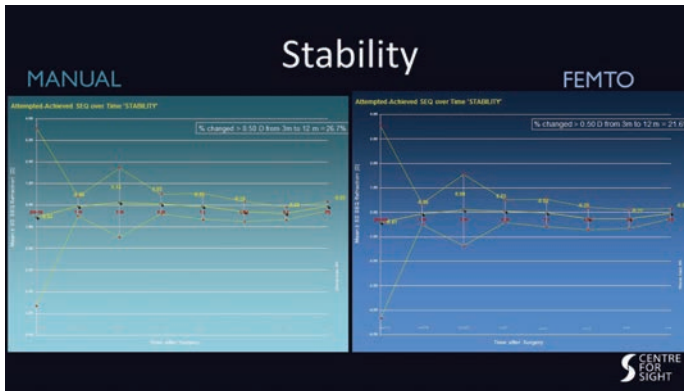
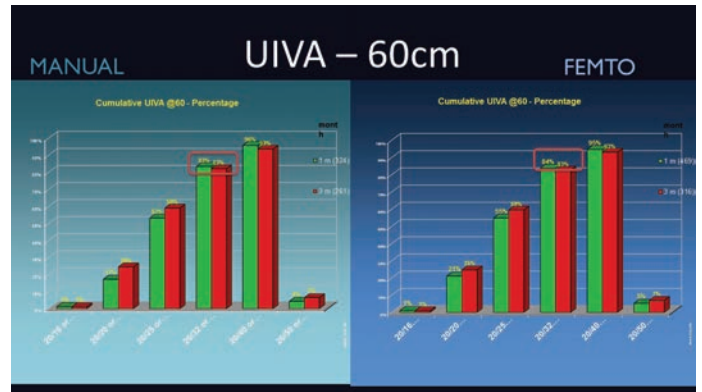
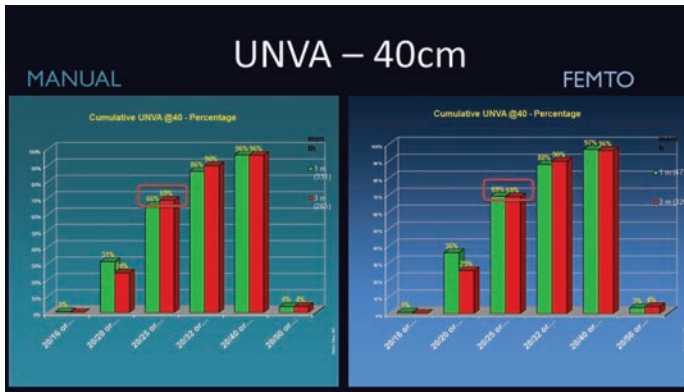


MANUAL

UDVA

FEMTO





‘Multifocal & Accommodative Implants’ (slides 25-40)

AT LISA TORIC TRIFOCAL

- Hydrophilic Acrylic
- Single Piece Plate Haptic
- 11.0mm length
- No angulation
- Implantable – 1.8mm



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Patients and Methods

- Eye Marked preoperatively on Axis
 - Using Corneal Astigmatic Aberrometry
- Surgery
 - All cases Victus femtosecond LRCS & Stellaris
 - 1.8mm scleral incision
 - Lens implanted and rotated to axis
- Postop 1M and 3M
 - UDVA, UNVA, UIVA(60 & 80cm), Refraction
 - Lens orientation
 - Aberrometry
 - Dilation



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OUTCOMES

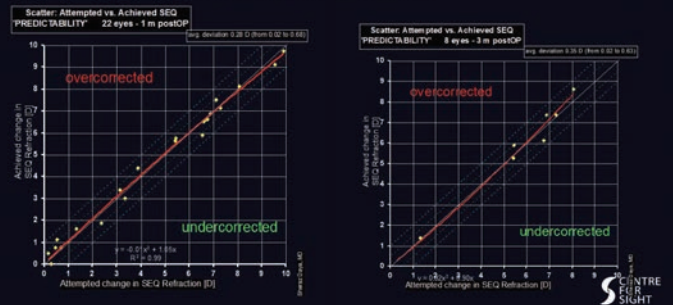
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REFRACTIVE OUTCOMES

	PREOP	POSTOP 1 M
Sph Equivalent	$-3.78 \pm 4.87 \text{ D}^*$ (range -12.63 to 7.13)	$-0.23 \text{ D} \pm 0.26 \text{ D}^*$ (range 0.13 to 0.75)
Cylinder	$-2.59 \text{ D} \pm 1.42 \text{ D}^*$ (range 0.75 to 6.00)	$-0.31 \text{ D} \pm 0.26 \text{ D}^*$ (range 0.00 to 1.00)

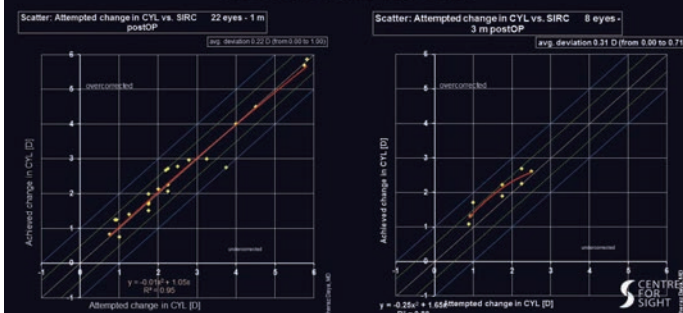
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PREDICTABILITY



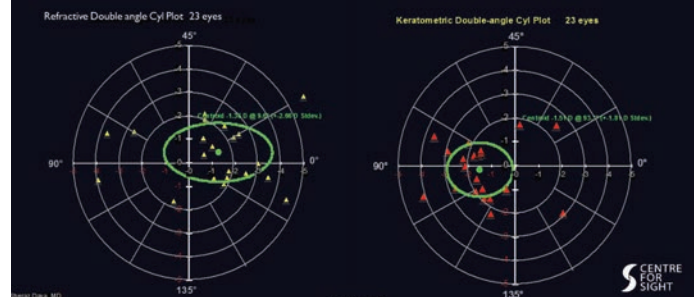
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ASTIGMATISM



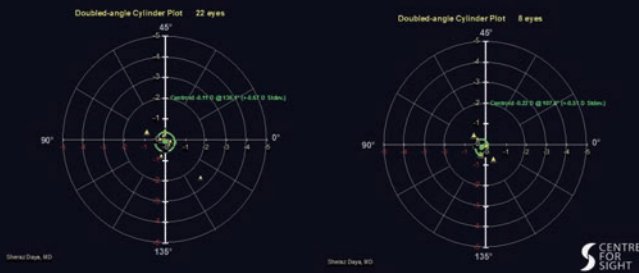
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Double Angle Plot - Preop



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Double Angle Cylinder Plot – 1 & 3 M



Conclusions

- Excellent refractive outcomes
 - Spherical equivalent
 - Astigmatism
- Spectacle independence – 100%
- High Patient satisfaction

Trifocal OPTICAL Concept

- Reliably provides patients with good vision @
 - Distance
 - Intermediate
 - Near
- As sure as you can get – Freedom from Spectacles

Premium Lenses

- Special Considerations:
 - ADAPTATION
 - Reading and intermediate improve with time
 - Haloes and glare reduce with time
 - DRY EYE
 - Can adversely affect vision – more sensitive
 - POSTERIOR CAPSULE OPACIFICATION
 - Reading vision affected first

Premium Lenses

- Do not prescribe Varifocals !!!
 - Loss of adaptation
 - Pushes the patient to use the distance portion of the lens

Consider...

- Good optical system
- Marriage between
 - Corneal optics
 - Lens optics
- Diagnostics - vital

New Generation Implants

- Complex area
- Art-form
- What do I use ?
 - Trifocals / Toric 95%
 - Monofocal & Toric 5%

Premium lens – making the choice

- Questionnaire
 - Occupation
 - Halos – compromise
 - Absolute requirement for intermediate
 - Visual needs
- Ocular Health
 - Glaucoma (strong family History)
 - Diabetes mellitus
 - ARMD

‘Multifocal & Accommodative Implants’ (slides 41-51)

Premium lens – making the choice

- Questionnaire
 - Occupation
 - Halos – compromise
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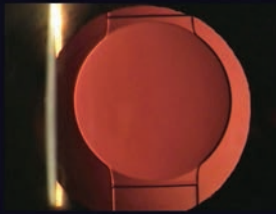


Premium Lens - Prerequisites

- Team based Practice
 - Educated counsellors and technicians
- Use patient education tools
 - Eyemaginations
- IOLmaster
 - A constant- customised
- Corneal Topography
 - Correct astigmatism accurately
- Access to refractive surgery
 - Treat residual refractive errors & astigmatism



Thank you...



Refractive & Cataract Update Part 2

Laser Eye Surgery & Femtosecond Laser Technology

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Laser eye surgery



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No-Touch Transepithelial PRK *The Teneo solution from Bausch and Lomb*

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Regular PRK – Epithelial removal



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Transepi PRK

Why?

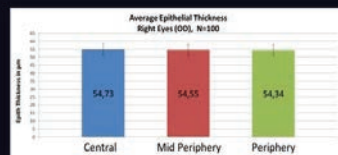
- All laser ablation – “No Touch Laser”
- More consistent removal of epithelium (customisable)
- Faster procedure
- Faster healing in regular corneas
- Less PAIN
- Useful for Corneal Irregularities
- Treatment of haze, corneal scarring ...
- Avoids vertical bubble breakthrough

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Trans-epi PRK –feasibility study

Feasibility Study conducted:

- Epithelial modelling
 - OCT maps of 100 eyes assessed for epithelial thickness
- Ablation algorithm design
 - Surgeon Selectable for epithelial removal
 - Can be used in conjunction with epithelial thickness measurements



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What's the NEW NEW Thing ?

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Introduced INTRALASE to the UK

Featured in the Daily Mail

Reported on Sky News & ITV



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'Laser Eye Surgery & Femtosecond Laser Technology'

(slides 1-8)

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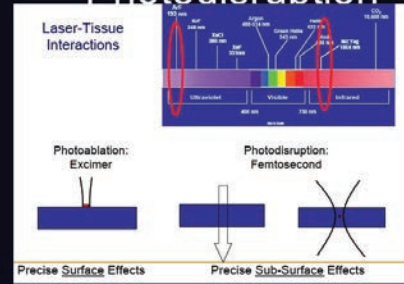
LASIK and IntraLASIK

- Laser 'in situ' Keratomileusis
- Intralase LASIK



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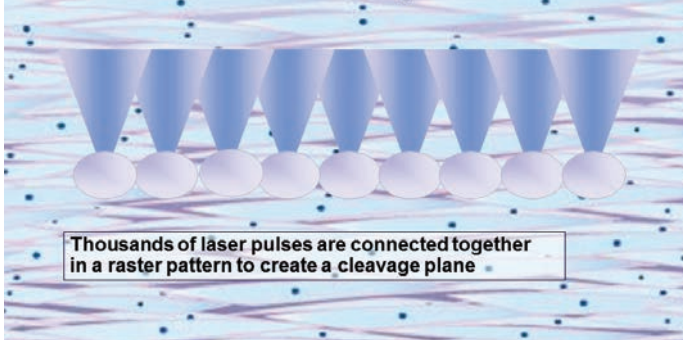
Photoablation vs. Photodisruption



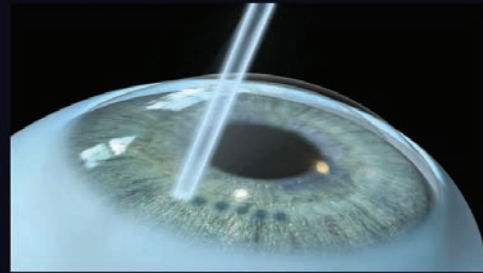
Courtesy Ron Krueger MD

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INTRALASE™ Photodisruption

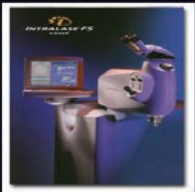


INTRALASE – How it works... Photodisruption



Femtosecond Laser

- INTRALASE – the ALL LASER Lasik



Femtosecond Laser

- Other USES
 - Corneal Transplantation
 - Tunnels for Rings
 - Cataract Surgery

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‘Laser Eye Surgery & Femtosecond Laser Technology’

(slides 9-15)

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