CHOOSE THE RIGHT INTRA OCULAR LENS

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Decisions to make

- Hydrophylic – Hydrophobic
- Design
  - Square - round edge optic
  - Haptic design – Plate haptic
- Spherical – Aspherical
- Full transparent – Blue blocking
- Spherical – Toric
- Accomodative
- Monofocal – Multifocal
  - Refractive - Diffractive
- Extended depth of focus
LENS DESIGN : MATERIAL & ISSUES

- **Material:**
  - Hydrophylic (acrylic/PMMA) contains water
  - Hydrophobic (acrylic or silicone) resists water

- **Design:** square optic edge (prevent PCO)

- **Haptic**
  - prevent tilting, movement of IOL (capsular fibrosis)
  - posterior capsule striae & folds

- **Problems to avoid:**
  - PCO (capsular biocompatibility)
  - foreign body reaction (uveal biocompatibility)
In search of the perfect optic: Asphericity

- Minimize spherical aberrations
- Minimize tilting (Coma)
- One focal point
- Crystal clear image
- Better contrast sensitivity
Aging of the eye

Normal cornea
- 0 to pos sph aberr 0.33u
- Stable throughout life

Crystalline lens
- Young age
  - Negative sph aberrations
  - Better contrast sensitivity
- Older age
  - Increase of sph aberr
  - Pos sph aberration
  - Less contrast sensitivity
Aging of the eye

Normal cornea
- 0 to pos sph aberr 0.33u
- stable throughout life

Myopic LASIK
- positive spherical aberrations

Hyperopic LASIK
- negative spherical aberrations

Crystalline lens
- Young age
  - Negative sph aberrations
  - Better contrast sensitivity
- Older age
  - Increase of sph aberr
  - Pos sph aberration
  - Less contrast sensitivity
Asphericity of IOL’s

- **Comea**
  - Hyperopic LASIK
    - Neg sph aberr
  - Normal cornea
    - 0-0.33u pos sph aberr
  - Myopic LASIK
    - pos sph aberr >0.3u

- **Intra-ocular lenses**
  - → standard spherical IOL
    - Positive sph aberr
  - → aspheric IOL
    - Neutral to neg sph aberr
      - Akreos (B&L) 0 sph aberr
      - Tecnis (Abbott) -0.27
      - Acrysof IQ (Alcon) -0.20
In search of the perfect optic
Asphericity

- Minimize spherical aberrations
  - → one focal point
  - → crystal clear image
  - → better contrast sensitivity

- Decreases depth of focus
  - → less intermediate & near vision
Presbyopia correction with IOL

- Monovision
- Accomodative
- Extended depth of focus
- Multifocal
Monovision

- dominant eye distance / non-dominant -1.25
- Price issue
- Less glare/halo but loss of stereopsis
Accomodative or pseudo-accommodative IOL

- Optic shift: 3D needs movement of 2.2mm -
- Forward-backward axial movement of IOL
- Flexibility in lens thickness
- Problems:
  - Current technology, not enough accommodative effect to provide functional near vision
  - Capsular fibrosis
  - Aging ciliary muscle not enough muscular force?
  - Posterior capsular opacification
  - Asymmetrical vaulting and tilting
NEW aberrated IOLs:

- Extended Depth Of Focus IOL (EDOF)
- Multifocal IOL
Extended depth of focus (EDOF)

- First EDOF: Monofocal with positive spherical aberration
- Mini-Well (SIFI) : 3 zones of different asphericity giving continuous vision
- WIOL-CF : Wichterle IOL Continuus Focus
  - Negative spherical aberrations
  - Mimics natural lens
  - Polyfocality
  - Hydrogel to mimic natural lens
Refractive Cataract Surgery: Extended depth of focus (EDOF)

- Diffractive: AT-Lara (Zeiss) / Symfony (Abbott)
  - Modification of height, spacing and profiles of echelette → EDOF
- Photic phenomena
- Less near vision
Refractive Cataract Surgery: Extended depth of focus (EDOF)

- Refractive: Comfort (low add refractive)
  - Bifocal +1.5 add
  - Improved intermediate vision
Refractive Cataract Surgery: Extended depth of focus (EDOF)

- Refractive + Diffractive + spherical aberration: SAV-IOL (Swiss Advanced Vision)
  - Lucidis & Eden
  - → central aspheric (Lucidis)
  - → 6mm refractive (Lucidis)
  - → Lucidis + 3.5mm diffractive (Eden)
Refractive Cataract Surgery: Extended depth of focus (EDOF)

- Pin-hole: IC-8 IOL
  - → irregular cornea
  - → increased depth of focus
  - → 1.36mm central aperture
  - → good distance, intermediate and near vision
  - → similar to Kamra inlay
  - → Possible for post-refractive, irregular corneas, monofocal pseudophakia
Refractive Cataract Surgery: Extended depth of focus (EDOF)

- Spherical aberration
- Diffractive
- Refractive
- Pin-hole
  - not enough for reading vision
  - elongated focus distance to enhance intermediate and near vision
  - less glare and halos compared to multifocal
  - Solution: mini-monovision, mix & match
Refractive Cataract Surgery: Multifocality

- Diffractive optics
- Refractive optics
  - Bifocal
    - → functional distance & near vision
  - Trifocal diffractive
    - → functional distance, near & intermediate vision
Optical aberrations: glare & halo

Monofocal

EDOF

Multifocal
Optical aberrations: distance vision

Monofocal  EDOF  Multifocal
Optical aberrations: intermediate vision

Monofocal  EDOF  Multifocal
Optical aberrations: near vision

Monofocal  EDOF  Multifocal
Refractive pearls for the cataract surgeon

- Multifocal?
- Monovision (with spherical or aspherical IOL??)
- Extended depth of focus?
- Accomodative (current technology not sufficient)
Multifocal IOL vs Monofocal IOL
Cochrane study (2016)

- distance VA: little difference to monofocal
- Near VA: multifocal better outcome
- Glare and halo’s: more in multifocal
- Patient less spectacle dependent with multifocal

- ECCE / Can-opener
- IOL used Refractive / Diffractive (older models: Array-Rezoom-3M)
Multifocal IOL: safety

- ESCRS-ASC RS explantation study (Mammalis, 2008)
  - Multifocal: 24% (10% market)
    - glare & halos
  - Monofocal: 76% (90% market)
    - decentration / dislocation / incorrect power
Multifocal IOL vs Monovision: Cochrane study (2016)

- 2 studies
- No difference for UCVA-distance-intermediate and near
- Multifocal less likely to be spectacle dependent (especially for near)
- Contrast sensitivity
  - marginally better in Monovision (1 study)
  - Same in other study
- More glare in multifocal
- Multifocal more IOL-exchange (6 eyes vs 0 in first year)
Multifocal IOL

- Critical success factors:
  - Achieving emmetropia
  - Correction of astigmatism
    - Arcuate incisions
    - Toric IOL
  - Centration
  - Patient motivation
ASTIGMATISM MANAGEMENT: TORIC IOL

- 20% 1.5D astigmatism
- 10% 2D or more astigmatism

Toric IOL

Standard IOL + >1 diopter of astigmatism
Refractive Cataract Surgery

- Target is to achieve emmetropia
- Choice of lens material & design
- Correct IOL-calculation
  - corrects spherical equivalent
- Small incision surgery
  - minimises induced astigmatism
- Correction of astigmatism
  - Toric IOL
- Correction of presbyopia
  - multifocality
  - Mini-monovision EDOF
  - Monovision
Many options to choose: your decision!!

THANK YOU