Surgical Correction of Presbyopia 2017
The Hype; The Hope

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ARENA EYE SURGEONS

Presbyopia

- Accommodation: Ciliary contraction allows zonular ligament relaxation, expanding axial lens thickness
- Presbyopia: Reduced lenticular alpha-crystalline hardens lens
  - Child: 20 D accommodative amplitude (50mm near point)
  - 25 y.o.: 10 D (100mm near point)
  - 40 y.o.: 5-1.5 D (1-2 meters near point)

Correction of Presbyopia

Presbyopia Surgery Approaches

- Laser Vision Correction
- Intraconal Options
- Lens Based Options

Laser Vision Correction of Presbyopia

- Monovision Options:
  - Age 38-44: many tolerate mild myopia, usually non-dominant eye
  - Age 45-54: residual error of 0.00 to 1.75
    - Demonstration with contact lenses presp useful, esp hyperopes
  - Age > 55: Best used in previously successful CL candidates
  - As patient ages, more near can be added, “tricky”

Laser Vision Correction: iLASIK
Alcon FS 200 Flap/Pocket Femto

- Updated image analysis
- Updated excimer
- Updated femto flap technology
  - Can create pockets,
  - Customizable flaps
  - Excimer created multifocal surfaces less successful
Laser Vision Correction: SMILE

- Small Incision Lenticule Extraction
- Essentially all femto LASIK, no excimer
- Ziem Meditech laser approved
- No flap, just pocket
- May be less dry eye risk
- May be less ectasia risk
- Difficult to treat cylinder as accurately as LASIK and PRK

SMILE Procedure

- Use in presbyopia correction limited to monovision target
- May in future be capable of creating multifocal surface by selected mid-stromal tissue ablation

SMILE Procedure

Corneal Inlay Options: KAMRA Inlay

- 1st U.S. approved presbyopia intracorneal inlay: Polyvinylidene fluoride (PVDF)
- Pinhole principle:

Intracorneal Inlay Options

- Inlay option extending range of eye without altering corneal curvature: KAMRA Inlay, centered with AcuTarget HD image device
- Inlay option altering corneal curvature: additive options
- Raindrop Inlay: implanted under flap, 1/3rd depth
- Flexivue Microlens (Presbia): hydroxyethylmethacrylate additive lens, 3.2 mm diameter, 0.15 mm thick edge, CT varies w/power, central hole for nutrient passage, +1.50 to +3.50, Investigational in U.S.

Intracorneal Inlay Options: KAMRA
KAMRA Inlay: Patient Selection and Results

- Age 45-60, non-dominant eye only
- Good UCDVA, some pts. note slight reduction of DV
- Need +1.00 to +2.50 for near tasks
- No CVD, HSV, POAG or AODM
- 83.5% achieved at least 20/40 UCNVA at one year (FDA submission)

KAMRA Inlay: Risks and Complications

- Blurred, ghosted or double vision
- Reduced CSP, night vision
- Color disturbances
- Glare, haloes
- Dryness, red eye
- Vision may not revert to preop with KAMRA removal
- Swelling, thinning, inflammation

Intracorneal Inlay Options: Raindrop Inlay

- Raindrop Inlay: Additive concept vs Pinhole
- 77% Hydrogel, 1.37 refractive index (cornea 1.34)

Raindrop Inlay: Patient Selection and Results

- 41-65 years of age
- MRSE +1.00 to -0.50, < 0.75 cyl
- Good UNDVA
- Photopic pupil > 3mm
- Mesopic pupil < 7 mm
- > 500 micron pachymetry
- Healthy ocular surface, no keratoconus or distortion
- No HSV, glaucoma, AODM

Raindrop Inlay: FDA Submission Results

- 88% could read fine print
- 92% could read a newspaper
- 74% could read an email or computer document

Raindrop Inlay: Complications

- Loss of BSCVA
- Night glare
- Reduction of Contrast Sensitivity
- Increased distance acuity
- Corneal clouding, thinning, inflammation
**Scleral Surgery**

- VisAbility Implant System
  - 4 PMMA plastic segments under scleral tunnels expand scleral tissue enhancing accommodation. Bilateral surgery. Difficult and evolving surgical technique. Spares cornea; only works if phakic.
  - Early to mid FDA trials ongoing

**Lens Based Options**

- Monovision Options: traditional monofocal IOL’s used to intentionally leave one eye myopic.
- Multifocal and extended range of focus IOL’s.
- Entering an era of better IOL’s and higher expectations!

**Presbyopic Lens Based Options**

- Early generation multifocal IOL’s:
  - 3-M
  - Array
  - ReStor
  - ReZoom
- Next Generation
  - New ReStor
  - Tecnis Multifocal
  - Symfony Extended Range

**Presbyopic IOL’s**

- Early Multifocal Lenses
  - Patient selection!
  - Patient selection!
  - Patient selection!
  - More achieved Spectacle independence
  - More explanted than in monovision group

**Newer Presbyopia IOLs**
Crystalens: Pseudoaccommodative IOL

- Approved in U.S for surgical implantation in 2010
- Multiple generations, design updates, disclaimers
- Less dysphotopsia, night issues vs. multifocal IOL's
- Documenting actual accommodation difficult
- Range of near vision limited
- Many recommend “mini-monovision” target

“New Generation” Multifocals

- ReStor: Alcon: Diffractive Technology
  - 4 Diopter Add
  - +3.0 spec plane
  - +2.37 spec plane
- Tecnis Multifocal: 3 piece and 1 piece
  - 4 Diopter Add: ZMBOO
    - +3.00 spec plane
  - 3.25 Diopter Add: ZLBOO
    - +2.37 spec plane
  - 2.75 Diopter Add: ZKBOO
    - +2.01 spec plane

Extended Range of Focus IOL's

- Tecnis “Symfony” (ZXR00 lens)
- Provides improved intermediate and near vs monofocal IOLs

Extended Range of Focus IOL's

- Alcon +3.0 ReStor multifocal may give same EDOF properties of Symfony
- All require < 1.0 D cylinder

Toric Multifocal

- Symfony Toric Approved
  - 0.6 to 2.0 D corneal plane power range (ZXR series)
- Acrysof IQ +3.0 Toric Approved
  - 0.6 to 2.0 D corneal plane power range (ZXR1T2-5)

Implants in Development

- Secondary sulcus options
- Fluid optic IOLs
- Truly accommodating lenses
Presbyopia Correction

- Multiple approaches available
- Different technologies can apply to different patient needs, expectations, RX tolerance, refractive error, cataract status, age etc.
- Understanding the patient’s needs and tailoring the correction offered can lead to extremely satisfied patients
- Careful workup and meticulous preparation and surgery can avoid extremely unhappy patient outcomes
- These many approaches offer the surgeon a variety of ways to meet each patient’s needs
- The Holy Grail of truly accommodative correction remains elusive

Thank You!