New Pinhole Intraocular Implant for Irregular Astigmatism
In-Depth Information for Secure Adoption of this New Technology

May 7th, Saturday 3:00PM - 4:30PM

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Financial Disclosure

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Fernando Trindade MD PhD
No financial interest

Bruno Trindade MD
No financial interest

Liliana Werner MD PhD
Abbott Medical Optics
Alcon Laboratories, Inc.
Bausch + Lomb Surgical
Cincinnati Medical/OCR
Hoya
Lenses
MedCorneur
Monoxys
Oncora
Powerticon
Zeiss

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Alcon Laboratories, Inc.
Bausch + Lomb, Inc.
SHI Beaver-Vido International
Cornea Matters, Inc.
Clarity Medical Systems
MST
Omeros Corporation
VCRS

Marcony Santhiago MD PhD
Ziemer, Inc., B

Course Structure

Early Development / Background
Indications
Surgical Technique
Injectors
Small Aperture Optics
Ciliary Sulcus
Visual Field
Low Light
Complications
Indications

- Post-RK
- Post-PK
- Keratoconus
- Trauma
- Post-LASIK
- Pterygium
- Pseudophakic presbyopia
Pre-op evaluation

Pinhole acuity without correction
Pinhole acuity with best correction

Irregular Astigmatism Refraction
Don’t trust autorefractors

Keratometric ≠ Refractive
Axis and magnitude

UBM
Trauma and anatomical variations

Case Presentation

RK + Fixed mydriasis
PK + Corneal rings
Keratoconus + Corneal rings
Extensive Corneal laceration + iris loss
Mydriasis after acute glaucoma
In-the-bag implantation
The Stiles-Crawford effect. Dilated pupils achieve a lesser degree of visual response per unit of light energy than contracted pupils.
Contrast Sensitivity
3 cd/m²

Wilcoxon Signed Rank Test

before

after

p (distance) = 0.028
p (near) = 0.078

Wilcoxon Signed Rank Test
**POST-RK**

**UCVA**

**before**
- 20/200 J6
- 20/200 J16
- 20/100 J4
- 20/200 J4
- 20/200 J16

**after**
- 20/40 J2
- 20/70 J5
- 20/40 J2
- 20/50 J2
- 20/100 J4

\[ p \text{ (distance)} = 0.042 \]
\[ p \text{ (near)} = 0.042 \]

Wilcoxon Signed Rank Test

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**KCONUS**

**UCVA**

**before**
- 20/80 J3
- 20/100 J3
- 20/200 J16
- 20/60 J3
- 20/100 J4
- 20/200 J5

**after**
- 20/30 J1
- 20/50 J1
- 20/80 J7
- 20/25 J2
- 20/40 J2
- 20/30 J4

\[ p \text{ (distance)} = 0.028 \]
\[ p \text{ (near)} = 0.026 \]

Wilcoxon Signed Rank Test

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**Injectors**

**Avoid**
- flat rod tip

**Prefer**
- cylindrical rod tip
Medicel Viscoject
LP604340C
2.2 - 2.4mm

Device: Spectrophotometer SPECORD 50 PLUS, Analytik Jena AG
Accessories: Aperture, diameter 3.0 mm
Parameter File: UV-VIS-Scan 140722
Display: Transmittance
Correction: Reference
Lamp change at: 320 nm
Mass. mode: Spectral Scan
Range: 300 – 1500 nm
Delta lambda: 1 nm
Speed: 50 nm/s

![Graph showing transmission against wavelength]
Influence of miotics on visual fields in glaucoma

Max Fekecs

The use of miotics may significantly affect visual fields. In the presence of miotics, visual field changes are observed, and these changes may be progressive. Progressive visual field damage in patients with glaucoma has been documented in several studies, with some researchers suggesting a correlation between miotic use and visual field loss.

The effects of miotics on visual fields in patients with glaucoma include:

1. Progressive vision loss:
   - Miotics can cause progressive vision loss in patients with glaucoma.
   - This loss is often associated with a decrease in sensitivity at the periphery of the visual field.
   - Progressive visual field loss can lead to significant problems with daily activities and mobility.

2. Changes in visual field configuration:
   - Miotics can cause changes in the configuration of the visual field, leading to a loss of peripheral sensitivity.
   - These changes can be subtle and may go unnoticed by patients and clinicians.

3. Increased risk of visual field damage:
   - The use of miotics in patients with glaucoma increases the risk of visual field damage.
   - This risk is particularly pronounced in patients with advanced glaucoma.

4. Impact on visual function:
   - Miotics can significantly impact visual function in glaucoma patients.
   - This impact can range from mild to severe, depending on the individual's baseline visual function and the severity of their glaucoma.

5. Management considerations:
   - The use of miotics in patients with glaucoma requires careful management.
   - This management involves monitoring visual fields regularly and adjusting treatment as needed.

6. Patient education:
   - Patients with glaucoma and miotics should be educated about the potential impact of miotics on visual fields.
   - They should be informed about the importance of regular visual field monitoring and the need to report any changes in vision.

7. Long-term effects:
   - The long-term effects of miotics on visual fields in glaucoma are not fully understood.
   - Further research is needed to fully understand the impact of miotics on visual fields in glaucoma patients.

In conclusion, the use of miotics in patients with glaucoma can significantly affect visual fields. Clinicians should be aware of the potential impact of miotics on visual fields and manage patients accordingly.

References:


Physiologic contrast. Contrast between test object and background is enhanced at lower levels of retinal illumination. This factor increases the effectiveness of the contracted pupil.

There appears to be reasonably uniform agreement that miosis produces a general depression of the visual field similar to that resulting from decreased brightness or size of the test object at a constant level of background illumination; at times this
Complications

- Decentration
- Upside down
- Asymmetric implantation
- Haptic amputation
Pinhole iris-fixated intraocular lens for dysphotopsia and photophobia

Gonzalo Muñoz, MD, PhD, FEBO, Stephanie Roberweck, MD, PhD, Hani F. Saka, MD, PhD, Wassim Almoadi, MBChB, APSA

We present the pinhole intraocular lens (IOL), with rigid iris-fixated haptics and a central opening, the pinhole. The IOL was inserted in the right eye of a 52-year-old man with a history of bilateral photophobia. The IOL was placed in the anterior chamber and the pinhole was created using a laser. The patient reported significant improvement in visual symptoms and a decrease in photophobia.

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Pseudophakic Presbyopia

![Defocus Curve](image)
Uncorrected Near Vision
Monocular

Before
After

Subjective Spectacle Independency

p=.008

Far
p=.565
People across street
Drive a car

Intermediate
p=.030
Cook
Play a board game

Near
p=.012
Read book
Read newspaper
Complications of sulcus placement of single-piece acrylic intraocular lenses

Recommendations for backup IOL implantation following posterior capsule rupture

David F. Chang, MD, Samuel Maskar, MD, Kevin M. Miller, MD, Rosa Braga-Mele, MD, Brian C. Little, MD, Nick Maramis, MD, Thomas A. Cetring, MD, Mark Packer, MD, for the ASCRS Cataract Clinical Committee

PURPOSE: To describe complications arising from sulcus placement of single-piece acrylic (SPA) intraocular lenses (IOLs), evaluate IOL options for eyes that lack adequate capsule support, and examine the appropriateness of various IOL designs for sulcus placement.

SETTING: University and private anterior segment surgery practices.

METHODS: Patients referred for complications of SPA IOLs in the ciliary sulcus from 2006 and 2008 were identified. Demographic information, examination findings, and complications of the initial
1) Interlenticular Opacification
2) Material (Hydrophobic x Hydrophilic)
3) Optimal Design Characteristics for Sutlus Fixation
   (Standard and Add-On IOLs)
4) Pigmentary Dispersion
5) Cadaver Eye Studies on Add-On IOLs

Interlenticular Opacification

- Interlenticular Opacification” (ILO),
  “Interpseudophakos Elschnig Pearls” or
  “Red Rock Syndrome”
  -Opacification of the opposing surfaces of piggyback intraocular lenses

- Explantation; lenses analyzed in our Center
Slide 4


Slide 5

Surgical methods proposed for ILO prevention

Slide 6

- **Hydrophobic surfaces:**
  Sharper angles of contact (the drop stands up)

- **Hydrophilic surfaces:**
  Flatter angles of contact (the drop spreads out)
- To compare hydrophobic characters of various hydrophobic acrylic IOLs
- Evaluate surface stability to hydration
  - AcrySof (Alcon)
  - Sensar AR40e (AMO)
  - AF-1 (Hoya)
  - Eternity (AVS/Santen) (enVista material/B&L)
- Evaluation of contact angles for dry IOLs and for IOLs hydrated at 37°C in BSS (1, 2, 3, 7, 14, 21, and 28 days)

- All dry lenses were found to be hydrophobic
- 24° drop in contact angle for the AcrySof (to 54°)
- 16° for the Sensar AR40e (to 74°)
- 18° for the AF-1 (to 70°)
- 3° drop for the Eternity (enVista material) (to 73°)
Slide 10

- Hydrophobic acrylic IOLs show same level of hydrophobicity in dry state
- Changes in contact angle observed upon hydration


Slide 11

“Sulcus IOLs: Don’ts”

- 1-piece hydrophobic acrylic lens not indicated for sulcus fixation
- Flexibility/thickness/bulk of haptics
- Square optic and haptic edges
- Unpolished side walls
- Haptics planar, do not vault the optic posteriorly from the iris
- Lens diameter up to 13.0 mm, too short for many eyes
- If haptics do not fully extend (low compressive force), IOL prone to decentration in larger eyes


Slide 12

- Three cases: Presence of haptics in the ciliary sulcus caused different degrees of pigment dispersion, uveitis, raised intraocular pressure, and hemorrhage

Slide 13

Slide 14

Slide 15
- Piggyback 3-piece lens with a square edge on the anterior optic surface

• Pigmentary dispersion from sulcus fixation of 3-piece lenses with a square edge on the anterior optic surface found in some studies


• In other studies, excessive interaction between the anterior square optic edge and the posterior iris surface not found


Slide 17

• Study using pseudophakic eyes obtained postmortem
• To compare pathology of 3-piece foldable IOLs with square or round anterior optic edges
• 13 hydrophobic acrylic 3-piece square anterior/posterior optic edge IOLs
• 14 3-piece IOLs w/round anterior optic edges (13 - silicone; 1 - hydrophobic acrylic)


Slide 18

Histopathology
Square Optic Edges on Anterior and Posterior Surfaces

Slide 19

Histopathology
Square Optic Edges on Anterior and Posterior Surfaces


Slide 20

**“Sulcus IOLs: Dos”**

- Posterior iris clearance
- Loops angulated posteriorly
- Thin loops
- Smooth anterior surface
- Round anterior optic edge
- Secure fixation
- Minimum optic diameter of 6.0 mm
- Minimum overall diameter of 13.0 mm


Slide 21

**“Sulcus IOLs: Dos”**

- Large diameter PMMA IOL
- Large diameter 3-piece silicone IOL

Other considerations:
- Appropriate capsular support; otherwise suturing
- If well-centered CCC, with diameter slightly smaller than optic: *optic capture*
- Adjust the power of the sulcus IOL (if no optic capture)
Slide 22

**Pigmentary Dispersion: Add-On IOL**

- Add-On IOL explanted because of calcification after DMEK

Slide 23


- Pseudophakic human eyes obtained postmortem
- Previous in-the-bag IOL implantation
- Eyes of different sizes; implanted with different in-the-bag IOLs; different amounts of Soemmering’s ring formation
- Preoperative very-high frequency ultrasound (Artemis, Ultralink)
- Add-On IOL implantation; Postoperative ultrasound
- Miyake-Apple posterior view, anterior view, oblique view, etc

Slide 24

**Example 1**

In-the-bag IOL: Single-piece hydrophobic acrylic
Axial length: 25.2 mm
Soemmering’s ring formation: 0

Preoperative
Postoperative
**Example 1**
In-the-bag IOL: Single-piece hydrophobic acrylic
Axial length: 25.2 mm
Soemmering’s ring formation: 0

**Example 2**
In-the-bag IOL: Single-piece hydrophobic acrylic
Axial length: 26.8 mm
Soemmering’s ring formation: intensity 4, area 4 quadrants

Distance between optics: 130 microns

Preoperative | Postoperative

**Example 2**
In-the-bag IOL: Single-piece hydrophobic acrylic
Axial length: 26.8 mm
Soemmering’s ring formation: intensity 4, area 4 quadrants
Example 3
In-the-bag IOL: Plate silicone
Axial length: 25.15 mm
Soemmering’s ring formation: intensity 3; area 2 quadrants

Preoperative

Postoperative

TYPE 93L PRELOADED

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<td>&quot;Optic&quot; Diameter</td>
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Slide 31

• Similar study with the Pinhole IOL (2 versions)
• Pseudophakic human eyes obtained postmortem (N = 10)
• Evaluation with anterior segment OCT (Visante, Zeiss)
• Miyake-Apple posterior view, anterior view, oblique view, etc

Slide 32

Eye 1

Eye 2

Eye 5

Eye 7

Slide 33

Eye 1
Potential Platform Advantages

- Large optic diameter: Reduced risk of optic-iris capture; quality of vision
- Round optic edge: Reduced dysphotopsia
- Large diameter undulating haptics: IOL centration and rotational stability
- Polished round edge, undulating haptics: Minimal tissue contact reaction
- Posterior optic-haptic angulation: Uveal clearance; decreased risk of optic-iris capture
- Optic configuration: Concave-convex; avoiding contact between the 2 IOLs decreasing likelihood of induced refractive error and optical aberrations

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Thank you

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