Instruction course:
Refining the Refractive Error After Premium IOL’s.

- Senior Instructor: Mounir Khalifa, MD
- Instructors: David Hardten, MD
  Scott MacRea, MD
  Matteo Piovella, MD

Dr. Khalifa: Causes of refractive error post premium IOL’s.
Dr. MacRae: Optic Bench Testing & Premium IOL’s.
Dr. Hardten: Management of residual astigmatism after toric IOL placement.
Dr. Piovella: How to manage unhappy patients after advanced technology IOLs implantation.
Discussion.

Causes of refractive error post premium IOL’s

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I have no financial interest related to this presentation.
Causes of dissatisfaction post premium IOL

**Preop:**
- Patient selection and consultation about the limitations and advantages of premium IOLs.
- Dry eye.
- Inaccurate marking of astigmatic axis.
- Inaccurate MR.
- Inaccurate biometry: high hyperopia, post LVC or RK.
- Pupil Size: Too large > 7 mm, or too small < 2.5 mm.
- Topography: to exclude irregular cornea, and to address corneal astigmatism.
- Aberrometry: High order aberrations (coma).

Coma & Multifocal IOL

- Recommended cut off: Consider in coma 0.25-0.33, contraindicated if coma > 0.33.
- Accordingly, aberrometry is required before multifocal IOL.

Astigmatism & Multifocal IOL’s

- 0.63 D is the benchmark for multifocals.
- > 0.63 D should be corrected if multifocal IOL is planned (ASCRS study).
OPERATIVE

- Capsule-related:
  CCC opening should be central, medium-sized (5-5.5 mm), regular, and the edge should cover the optic edge of IOL to enhance square-edge effect of IOL to prevent or retard PCO.

Operative: Misalignment of IOL axis in Toric IOL

- Decentered IOL: When IOLs are decentered 1.5 mm, there is far more image degradation with an IOL with negative spherical aberration (Tecnis) compared to zero spherical aberration (AO).

- Corneal wound: burning, dehiscence, too corneal etc.
POSTOPERATIVE

- Dry eye.
- PCO, capsular phimosis.
- IOL decentration.
- Toric IOL rotation.
- Macular dysfunction: DME, CME.


Consider deliberately removing viscoelastic from behind the toric IOL optic to minimize rotational instability.

- 1° of misalignment: 3.3% loss of correction.
- 30° of misalignment: 100% loss of correction (vector analysis).

The ORA System®
Clinically Proven to Increase Accuracy and Improve Outcomes

- Provides on-demand information which assists in intraoperative decision making
- Utilizes Talbot Moiré interferometry
  Large dynamic range -5 to +20D
- Enables real-time surgical course correction
  "Get it right – right on the table" the first time
- Compatible with and attaches directly to existing surgical microscopes
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12
Review of Clinical Applications

Provides guidance to improve accuracy in IOL power calculations
- Introperative Aphakic refraction: IOL power calculation
  - Standard IOL cases
  - Premium IOLs
  - Post-refractive surgery patients

Provides information to ensure more precise toric IOL outcomes
- Intraoperative Aphakic Refraction
  - Spherical power of IOL
  - Aphakic refractive cylinder power and axis
- Intraoperative Pseudophakic Refraction
  - Guidance for refining toric IOL orientation
  - Placement at the proper axis

Provides information for more accurate and consistent results when performing LRIs

Key Facts To Remember
- Selecting the right patient
- No ocular disease
- Ability to fixate – no blocking
- Preparing the eye
  - Homogenous solution to inflate the eye
    - Either BSS or viscoelastic, but not both
  - Ensure good tear film
  - Sealed incisions and avoid excessive edema
  - Proper IOP (21 mmHg)
- Taking a measurement
  - Microscope light turned off during capture
  - Patient fixating on the slowly blinking red
  - Maintain Z focus and XY alignment

The iTrace Helps
Every Cataract Patient Achieve
Their Best Potential Vision

Premium lenses must provide premium vision!

- Optical system alignment, with ray tracing
- Quantification and analysis of corneal aberrations with ray tracing
- Post-operative verification with ray tracing
Scan on pupil centration showing coma – but this patient does not complain of double vision.

Scan on visual axis centration, showing only cylinder.

Visual axis centration through spectacles showing very good correction.
Having off-setting data (X & Y) can be transferred to laser machine for ablating on the visual axis.

Internal aberrations compensating corneal aberrations - must consider prior to cataract surgery that corneal issues will be revealed.

Tilted Restor IOL with normal corneal surface.

Rotate lens 129° clockwise as shown in the diagram.

Digital color photo with iTrace can be used to mark limbal vessels or iris marks to guide axis rotation perfectly.
Wavefront-Guided Ablation after Spherical Phakic IOL to Correct Astigmatism

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I have no financial interest.

- Moderate to high myopia with significant astigmatism is a challenge to laser refractive surgery. Using toric phakic IOL is a safe and efficient solution. In some cases, misalignment of the cylinder axis can happen.
- Accuracy of registration of WF-guided ablation encouraged us to use it to correct astigmatism after spherical posterior chamber phakic IOL (BIOPTIC).

Also, in most of the cases, the astigmatism is on the corneal level which is better be corrected on the same plane.
Wavefront-Guided ablation has many advantages:

i) Wavefront measurements are 25 times more precise than a manifest refraction
ii) Objective measurement of the patient’s entire optical system.
iii) Help reduce or maintain higher order aberrations
iv) Iris Registration and pupil centroid shift (Star S4IR) which ensures accurate axial and torsional registration.

We did a study to evaluate the efficiency of wavefront-guided PRK after posterior chamber phakic IOL (spherical ICL - STAAR) to correct moderate to high myopia with astigmatism in cases beyond limits of LVC alone.

Spherical ICL was implanted to correct spherical myopia. ICL power was chosen to leave eye with spherical error -0.5 to -1.0 D.

1-6 months later, wavefront-guided PRK was done to correct the remaining refractive error using Visx Star S4 with IR.

Preoperative UCVA, BCVA, MR, contrast sensitivity.

Pentacam was used for K readings, ACD, white to white corneal diameter.

UCVA, BCVA, MR, contrast sensitivity, and HOA’s were measured after ICL implantation and after WF-guided PRK.
Means of sphere and cylinder at different stages.

-16 -14 -12 -10 -8 -6 -4 -2 0

PreICL PostICL Post WF-PRK

Sphere Cylinder

Efficacy of ICL=1.6
Efficacy of WF=1.0

UCVA BCVA

Contrast Sensitivity showed significant improvement postICL and no significant change postWF.
Comparison of PSF PostICL and postWF

Corneal HOA’s showed no significant change after WF-guided ablation.

Conclusion

- Spherical posterior chamber phakic IOL (ICL) combined with wavefront-guided excimer laser ablation (BIOPTIC) is a safe and effective combination to correct moderate to high myopia with significant astigmatism in cases beyond limits of LVC.
- This technique significantly improved CS in the cases used to have their CS reduced after LVC to correct high myopia.
- There was no significant change either in ocular or corneal HOA’s.
**Decision Tree**

- Many Options at time of Cataract Surgery:
  - Accurate Biometry and Topography (ITRACY)
  - Intraoperative aberrometry (ORA).
  - Circular central CCC which overlaps 360 of IOL optic
  - Astigmatism management:
    - Corneal Relaxing Incisions – Blade vs. Femtosecond
    - Toric IOLs
    - Accurate marking
    - ORA intraoperative aberrometry

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**Postoperative**

- Regular refractive error → Wavefront-guided LVC, if there is reliable wavefront map.
- Irregular refractive error → Wavefront or topography guided LVC.
- PCO or phimosis → YAG capsulotomy
- IOL decentration or tilt → IOL exchange

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**THANK YOU**

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