ABERROMETRY AND MF IOLS: WHAT WE CAN LEARN

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FINANCIAL DISCLOSURES

Francesco Carones, MD consults for the following companies:

• Alcon Laboratories (relevant to this presentation)
• CSO (relevant to this presentation)
• Johnson & Johnson Vision (relevant to this presentation)
• Slack (not relevant to this presentation)
• Vivior (not relevant to this presentation)
• WaveLight (not relevant to this presentation)
WAVEFRONT SENSING TECHNOLOGY

- Hartmann-Shack (Autonomous, AMO-VISX)
- Tscherning (WaveLight)
- Slit-lamp scanning skiascopy (Nidek)
- Ray Tracing (Tracey)
- Pyramid Wavefront Sensor (CSO, Schwind)
**EMMETROPIC RAY (SLOPE = 0):**
Y-AXIS

\[ A = B = C = D \]

**CONVERGENT RAY (SLOPE < 0):**
Y-AXIS

\[ A < C \quad B < D \]

\[ A = B, \, C = D \]
**DIVERGENT RAY (SLOPE > 0):**

\[ \text{Y-AXIS} \]

\[ A > C \]
\[ B > D \]
\[ (A=B, C=D) \]

**WAVE-FRONT ERROR**

Relationship Slope and Light Intensity

\[ \frac{\partial W}{\partial y} \propto \frac{A+B-C-D}{A+B+C+D} \]
\[ \frac{\partial W}{\partial x} \propto \frac{A+C-B-D}{A+B+C+D} \]
CSO **OSIRIS** ABERROMETER

Pyramidal Wavefront Sensor (PWS)
- Spatial resolution:
  - 45,000 data point (Ø= 9.0 mm) (1,500 other technologies)
  - 4,500 data point (Ø= 3.0 mm) (150 other technologies)
- Sensitivity:
  - 4096 shades of gray

**EXAMPLE:** MONOFOCAL IOL, -2.00D
EXAMPLE: MONOFOCAL IOL, -2.00D

Total aberrations

Low order aberrations

High order aberrations

EXAMPLES: PRESBYOPIA-CORRECTION DIFRACTIVE IOLS

BIFOCAL (ReStor 3.0)  TRIFOCAL (PanOptix)  EDOF (Symfory)
EXAMPLES: PRESBYOPIA-CORRECTION REFRACTIVE IOLS

Zonal Refractive (ReZoom)  Pos/Neg SA (MINIWELL)  Segmental Refractive (MPlus)

CLINICAL EVALUATION IN EYES IMPLANTED WITH PRESBYOPIA-CORRECTING IOLS

120 implanted eyes, 1-12 months after surgery
- 40 Alcon PanOptix (trifocal, diffractive)
- 40 J&J Vision Symfony (EDOF, diffractive echelette)
- 20 Alcon ReSTOR 3.0 (bifocal, diffractive)
- 10 Alcon ReSTOR 2.5 (bifocal, diffractive)
- 10 SIFI MiniWell (EDOF, positive/negative spherical aberration)
MAIN OUTCOMES – CENTRATION

Measurement in relation to the visual axis or center of the pupil
- Impact of decentration on PSF and Simulated Visual Acuity

MAIN OUTCOMES – DIFFRACTIVE PATTERN

Optical design detection in 100% of IOLs
- Central area diameter and focus
- Number of diffractive steps
- Dioptric value of add power
MAIN OUTCOMES – ADD POWER

Measurement of the dioptric range and multifocality
  • Dioptric range
  • Peak to valley

AD INTERIM CONCLUSIONS

The Pyramid Wavefront Sensor (PWS) proved highly sensitive and with a much higher spatial resolution than the other wavefront sensors
  • Much more detailed measurements
  • Very useful information

The software needs to be developed as to make all measured information more user friendly for researchers and clinicians
THANK YOU!