Imaging Modalities That Help Maximize Uncorrected Visual Outcomes After Cataract Surgery

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Imaging Modalities

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Tufts University School of Medicine
Ophthalmic Consultants of Boston

Financial Disclosure

• No relevant financial interest
Nidek OPD Scan III

- Auto refractor
- Keratometer
- Pupillometer – Photopic and Mesopic
- Corneal Topographer
- Wavefront Aberrometer
- 10 Seconds per eye capture time

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Retro Illumination Map

The Retro illumination maps allow you to show patients cataracts, vacuoles, cortical spoking, many times assisting in their decision to proceed with cataract surgery.

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Axial Map

The Axial map, captured utilizing Placido technology (33 rings, 11,880 data points) displays the numeric K readings over the entire surface of the cornea and the Sim Ks are also shown.
Placido Image

The Placido image map, allows you to evaluate OSD and discuss dry eye with patients as a pre-existing condition prior to surgery.

Courtesy of Mayah Shurbet
Senior Wavefront Clinical Specialist, Marco Ophthalmic, Inc.

TORIC IOL Summary

The OPD III automatically captures the Retro Illumination image. Allowing the use of the cataract as a landmark. The patient is measured sitting up and the spoke of the cataract is at 140° which is 30° from the steep axis. This map can be printed and taken to the OR.

Courtesy of Mayah Shurbet
Senior Wavefront Clinical Specialist, Marco Ophthalmic, Inc.

Cataract Evaluation

The OPD III allows the Anterior Surface of the cornea (Axial) to be subtracted from the total eye showing the Toric IOL implant in the Internal OPD map. Seeing that there is only +0.25D Cyl assures us that the IOL is at the proper Axis.

Courtesy of Mayah Shurbet
Senior Wavefront Clinical Specialist, Marco Ophthalmic, Inc.
TORIC IOL Summary

The Retro Illumination image also allows you to view the previous measurement and the alignment of the Toric IOL post-operatively with the steep axis overlaid.

Courtesy of Mayah Shurbet
Senior Wavefront Clinical Specialist, Marco Ophthalmic, Inc.

Cataract Evaluation

The OPD III allows the Anterior Surface of the cornea (Axial) to be subtracted from the total eye showing the Toric IOL implant in the Internal OPD map. You can automatically see that the implant is off resulting in a residual of +1.25D of cylinder.

Courtesy of Mayah Shurbet
Senior Wavefront Clinical Specialist, Marco Ophthalmic, Inc.

TORIC IOL Summary

The Toric IOL Summary allows the measurement of the distance of the alignment marks to the steep axis showing how many degrees the lens has rotated.

Courtesy of Mayah Shurbet
Senior Wavefront Clinical Specialist, Marco Ophthalmic, Inc.
1. Assess placido rings for OSD – mires are clean
2. Check Angle Kappa – 4.50mm is max for ReStor and 5.00mm is max for Tecnis – Angle Kappa is within range
3. Corneal Astigmatism – astigmatism less than 0.75D is to slightly asymmetric, lens would decrease to below 0.50D
4. Pupil size and normal mammillation

Multifocal Decision Tree – Good Candidate

Wavefront Summary

The OPD III displays a Zernike Graph of the OPD (Entire Visual System), Cornea and Internal OPD (lenticular). We can see in the corneal Zernike display that none of the numbers are over 0.33° for any of the main concerns, Trefoil and Coma. The high Trefoil indication on the OPD goes to the Internal when divided and is not from the cornea, it is coming from the lens which will be removed.

Conclusions

- Many new imaging technologies
- Evaluating corneal HOA can be helpful for screening for multifocal IOL patients
- Useful for evaluating postoperative refractive surprise with toric IOLs
VERION IMAGE GUIDED SYSTEM

Dr. KALPANA NARENDRA
Chief – Cataract and IO Services
Aravind eye hospital, India

VERION is an image guided system that has integrated preoperative planning, surgical guidance and post-operative refractive assessment for further improving refractive outcomes.

VERION reference unit
VERION Digital marker L
VERION Digital marker M
• Only the patient identification data is entered first.
• Thereafter all data is electronically transferred from one unit to the next.

Measurement module

• Keratometry
• Pupil diameter
• Limbus diameter
• Steep and flat axis
• High resolution image of the eye

A good scan

1. FOCUS: Vessels and iris structure focused.
2. LED REFLEX: All 12 led lights should be crisp and clear.
3. EXPOSURE: Majority of the limbus should be exposed.
4. FIXATION: Patient should look into the red fixation light.
The 12 LEDs cover a diameter of approximately 2.8mm

More than 300 images and 1000 data points are collected

Planning station

- Multiple drop down formulae
- Choose your target refraction

Choose from
1. SRKT
2. HAIGIS
3. HOFFER Q
4. HOLLADAY 1
5. HOLLADAY 2
6. HOLLADAY R
Verion digital marker-M

• Incision guide: It shows us the position of our pre-planned incisions.

• Capsulorhexis guide: arguably the most difficult step in cataract surgery is to get a round and accurate rhexis.

Centration guide: the most important thing for an IOL and particularly for multifocal IOLs are their centration.

Toric guide: it gives a hassle free method to implant a toric IOL without any ink-marking or human error.

TORIC IOL

• NO more marking the eye with ink for TORIC IOLs

• Reduces human error.

• Easier
Arcuate incisions

- Based on the slade/donnenfeld nomogram
- Paired arcuattes
- Nearly 50% of cataract patients have some degree of astigmatism

Improve outcomes

- Completes a loop from preoperative planning-surgical guidance – postoperative data.
  - A constant optimization
  - SIA calculation.

CONCLUSION

Verion image guided system helps us to reduce post-operative residual refractive error at many steps in the cataract surgery process
Imaging Modalities That Help Maximize Uncorrected Visual Outcomes After Cataract Surgery

iTrace
Visual Function Analyzer
Dr. Prabhu Vijayaraghavan M.S, FICO

iTrace

- Auto-Refractometer (Multizone)
- Wavefront-Aberrometer
- Corneal Topography (includes 3D)
- Pupillometer
- Auto-Keratometer
**TRACEY’S UNIQUE ADVANTAGES**

- All 256 points are used regardless of pupil size from 2.5 mm to 8mm
- Binocular Open Field Fixation – avoids instrument myopia
- Pupillometry and white-to-white measurement, Angle Alpha and Angle Kappa measurements
- Objective Accommodation measurements
- Robust and Compact Design.

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**What we can get out of it**

- Identify the source of aberrations and measures it so we can predict outcomes.
- Toric IOL planning, execution and enhancement
- Measures the Angle alpha and Kappa to decide on premium IOLs

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**Chang Analysis: WF & CT Summary Display**

- Wavefront/Interal Optica map
- Total wavefront analysis of the eye
- Corneal wavefront display
- Corneal topography map
1. **Corneal aberrations**.

- Corneal aberrations are contributing to most of the entire eye aberrations.

- Abnormal Cornea

- Spherical aberrations

  - Human Cornea is positively aberrated with Avg. value about +0.27µm.
  
  - Young human lens is negatively aberrated to compensate.
  
  - With age, natural lens is positively aberrated causing poor vision.
Spherical aberration:

Optimizing IOL’s for Cornea

- **<0.10μ**  
  Spherical IOLs
- **0.10μ – 0.25μ**  
  Zero Aspheric IOLs  
  B & L Envista, Rayner, Zeiss
- **0.25μ – 0.35μ**  
  Alcon IQ (-0.18μ), Hoya (0.20μ)
- **>0.35μ**  
  Tecnis (-0.27μ)

Aspheric Intraocular Lens Selection Based on Corneal Wavefront
Mark Fuster et al. Journal of Refractive Surgery  
January 2009 · Volume 25 · Issue 1: S12–S20

Toric IOL

- Wavefront data, Corneal topography measurements and user-entered data — best toric lens power and determine the best axis placement for that lens.

  1. Toric IOL planning.
  2. Cross-check reference marking.
  4. Post Toric enhancement planning and image guided rotation.
  5. IOL axis placement verification.

For optimal calculation, care should be taken to ensure the largest WF scan size possible. Darken the exam room and occlude the fellow eye if possible.
**Colour coding:**

- Solid blue line is incision location.
- Dotted red line is patient’s existing steep axis of corneal astigmatism.
- Dotted green line is patient’s existing steep axis of the astigmatism of the entire eye.
- Solid red line is the predicted post-op steep axis of corneal astigmatism.
- Six gold dots indicate the axis of placement.
- Solid green line is the predicted steep axis of the entire eye’s astigmatism.

**Zaldivar toric caliper...**

- Overlay in the iTrace software that assists with the precise placement of toric implants.
- Measures the angular distance between the axis of placement and a limbal reference mark or a landmark such as a vessel or iris detail.
- Limbal reference marks are often not placed precisely at the 3 o’clock/9 o’clock positions, so this tool compensates for this imprecision.

**Reference marking verification & correction**
Toric enhancement

Itrace suggests 30 Deg. clockwise rotation
Angle Alpha & Kappa

- Important for multifocal, toric IOL and aspheric IOL's.
- Automatically detects the limbus and the pupil, and white-to-white measurement and the pupil diameter.
- Locates the center of these two ellipses (blue for limbus, green for pupil) and marks them with a blue cross and green cross respectively.

Optical System Alignment

The IOL tends to center on the limbal center not over the visual axis.

A large angle Alpha combined with a multi-focal or toric gives compromised vision.

The result is potential complaints such as blur, double vision, halos, etc.

A better option may be a monofocal lens.
Imaging Modalities That Help Maximize Uncorrected Visual Outcomes After Cataract Surgery

**Orbscan Total Optical & Mean power in IOL power calculation for Post Myopic LASIK Cataract surgery patients**

Dr. Prabhu vijayaraghavan M.S, FICO

- Sonego-Krone et al... developed the method using Orbscan II in the IOL power calculation of eyes post myopic or hyperopic refractive surgery.

- Carlos G. Arce et al...
  First and largest prospective application of this method in the study
  “Calculation of Intraocular Lens Power Using Orbscan II Quantitative Area Topography After Corneal Refractive Surgery”

Intraocular lens power calculation in these cases is challenging.
“Significant postoperative hyperopic error (undercorrection) in eyes with previous myopic surgery”
Mean power map represent the spherical equivalent of each point in all meridians from each corneal surface. Total-mean maps are the addition of the anterior-mean, posterior-mean, and thickness-mean maps.

Optical power map also called refractive or Snell maps, represent the focal properties of the cornea. Total-optical maps consider the ray tracing of light through the whole cornea.


Calculation of Intraocular Lens Power Using Orbscan II Quantitative Area Topography After Corneal Refractive Surgery

The corneal power applied in this study is the average of all points contained within the 2-mm-diameter central zone of Orbscan II total-mean maps centered on the pupil, as measured directly from corneas with previous refractive surgery.

The paracentral 1.5- to 2-mm ring zones of the total-optical map have also produced good results.

Novel method of IOL Power Calculation Using Scanning-Slit Topography – Based powers in Myopic LASIK Cataract Surgery Patients: Retrospective Study

Aim:

To evaluate a novel method for calculating intraocular lens power after myopic LASIK using Orbscan total mean and optical power values and to compare it with IOL master and Manual keratometry methods.
• 12 Post myopic LASIK eyes of 10 patients had cataract sx ... July 2009 – Dec 2014

• IOL power
  1. Orbscan based Total Mean and Optical power at 1.5mm zone
  2. Immersion axial length method.
  3. SRK T & 2 formulae in IOL master

What we had done in the study...

Retrospectively Case records were reviewed

1. Manual and IOL master Keratometry values were compared to Orbscan based powers.

2. Above mentioned values of each patient were used in SRK T, SRK 2, Haggis, and Holladay 2 to find the suggested IOL powers and its Expected Residual Spherical Equivalents (ERSQ) using IOL master.

3. The ERSQ for the IOL power implanted already was also calculated in manual, IOL master K and orbscan values in all the above mentioned formulae and this was compared with the Achieved Residual Spherical Equivalent (ARSQ)

Ethical committee approval obtained: RET 201100099

Change in visual acuity

Mean LogMAR (SD)
Orbscan based powers Vs IOL Keratometry Vs Manual Keratometry

<table>
<thead>
<tr>
<th></th>
<th>IOL master</th>
<th>Orbscan 1.5 mm</th>
<th>Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1 Mean (SD)</td>
<td>36.06 (3.57)</td>
<td>Mean power 34.86 (3.14)</td>
<td>37.20 (6.66)</td>
</tr>
<tr>
<td>K2 Mean (SD)</td>
<td>47.44 (5.15)</td>
<td>Optical power 34.72 (3.51)</td>
<td>37.80 (7.64)</td>
</tr>
</tbody>
</table>

Comparison cont...

<table>
<thead>
<tr>
<th>P1</th>
<th>P2</th>
<th>P3</th>
</tr>
</thead>
<tbody>
<tr>
<td>k1</td>
<td>0.0076</td>
<td>0.0206</td>
</tr>
<tr>
<td>k2</td>
<td>0.0022</td>
<td>0.5956</td>
</tr>
</tbody>
</table>

Statistically Significant difference between all the values (except the K2 values of IOL master and Manual keratometry)

Post op. Achieved Residual Spherical Equivalent

Mean (SD) 0.77 D (1.19)

Range -2 to 2.75

No. of patients

Achieved spherical equivalent
### Expected Residual Spherical Equivalent for the suggested IOL power Vs ARSQ

<table>
<thead>
<tr>
<th>IOL Master K reading</th>
<th>Mean (SD)</th>
<th>Min – Max</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRK T</td>
<td>2.06 (0.94)</td>
<td>2.3 to 1.32</td>
<td>0.0022</td>
</tr>
<tr>
<td>Haigis</td>
<td>0.31 (1.72)</td>
<td>2.74 to 1.92</td>
<td>0.0029</td>
</tr>
<tr>
<td>Holladay 2</td>
<td>0.46 (1.01)</td>
<td>2.44 to 1.44</td>
<td>0.0040</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Orbscan based powers</th>
<th>Min (SD)</th>
<th>Min – Max</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRK T</td>
<td>0.35 (0.67)</td>
<td>1.9 to 0.7</td>
<td>0.7537</td>
</tr>
<tr>
<td>SRK 2</td>
<td>0.82 (0.88)</td>
<td>0.5 to 2.74</td>
<td>0.0060</td>
</tr>
<tr>
<td>Haigis</td>
<td>1.75 (1.83)</td>
<td>0.35 to 3.16</td>
<td>0.0110</td>
</tr>
<tr>
<td>Holladay 2</td>
<td>1.08 (0.84)</td>
<td>0.02 to 2.63</td>
<td>0.0186</td>
</tr>
</tbody>
</table>

### ARSQ vs ERSQ

<table>
<thead>
<tr>
<th>Achieved Residual Spherical Equivalent (ASRQ) in diopter</th>
<th>Mean (SD)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orbscan powers in SRK T</td>
<td>0.77 (1.19)</td>
<td>-2 to 2.75</td>
</tr>
<tr>
<td>Orbscan powers in Holladay 2</td>
<td>0.77 (1.19)</td>
<td>-2 to 2.75</td>
</tr>
</tbody>
</table>

* P value of less than 0.05 was considered statistically significant

### The correlation coefficient is 0.86

(P-value = 0.0003, using Spearman’s rank correlation coefficient).

- There is a good co-relation between the Expected and the achieved residual spherical Equivalent in Orbscan values in SRK T formulae with IOL master.
Conclusion

Orbscan based total mean and optical power values in SRK T formulae are more reliable than the IOL master or Manual keratometry values in post myopic LASIK patients for IOL power calculation.

Maximising Uncorrected Refractive Outcomes Post Cataract Surgery- Use of Lenstar

Dr. Sandra Chandramouli
Consultant
Aravind Eye Hospital
Coimbatore, India

What is LENSTAR?

Lenstar is an optical biometer that is capable of making highly accurate measurements
- Along the visual axis,
- Over the curvature of the cornea
- And in addition other parameters

That can be used to provide accurate estimations of patient’s IOLs.
Not just another Biometer …

Single scan
9 measurements
30 sec!!

Improved Refractive Outcomes

- All axial dimensions measured laser-optically (OLCR Technology)
- All parameters measured on the visual axis (patient fixated on the measurement beam)
- Fixation loss is detected, only good measurements are taken
- Improved refractive outcomes with measured lens thickness
- WTW and pupil diameter for premium IOL
- Improved refractive outcomes with measured lens thickness
- WTW and pupil diameter for premium IOL
- Accurate K-reading, high resolution red free image of the eye, T Cone - Toric IOL

Lenstar LS 900 vs. Zeiss vs. Tomey vs. US

<table>
<thead>
<tr>
<th>Measurement Features</th>
<th>Lenstar</th>
<th>Zeiss IOL Master</th>
<th>Tomey CA-900</th>
<th>Ultrasonic Biometer (Center Axis EPL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central cornea thickness (CCT)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Apex corneal depth</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>True anterior chamber depth</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Lens thickness</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Axial length measurement</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Keratometry</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Cornea’s astigmatism</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Turgidity</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>
OLCR Technology
(Optical Low-Coherence Reflectometry)

- SLD light source at 820nm
- Dual scanning system in which the reflection from a reference beam is used to calculate distances within the eye.
- Similar technology to OCT
- The IOL Master uses PCI
- While this has proven to be an accurate means to measure axial length it is not used to measure CCT or ACD

Lenstar Vs IOL Master

- LENSTAR has been proven to be comparable in accuracy to the IOL Master for axial length measurements
- Intra user variability is also very low as the unique alignment system on LENSTAR ensures that measurements are only made when the patient fixates correctly

Improved refractive outcomes
with measured lens thickness.

- Provides the surgeon with all the measurements necessary to take full advantage of the latest IOL prediction methods, such as the Holladay 2 and Olsen 1 formulae, now integral to the Lenstar.
- Measuring the lens thickness significantly improves the IOL prediction accuracy of Holladay 2 and leads to a different IOL power selection in 30% of cases.
White to White

- White to White analysis
  - Horizontal diameter of a circle fit to the limbus
  - Base for visual axis eccentricity
  - Used in 3rd and 4th generation IOL formulae
    - E.g. Holliday II

Pupillometry

- Pupillometry
  - Diameter of a circle fit to the pupil
  - Base for visual axis eccentricity, specialised for laser refractive application
  - Based on ambient light

What formula when?

- Mean absolute Prediction error for different eye length

<table>
<thead>
<tr>
<th>AS in mm</th>
<th>Mega AR All optional</th>
<th>Mega AR All &amp; C optional</th>
<th>Holliday C AR optional</th>
<th>Holliday 1 AR optional</th>
<th>Holliday 2 AR optional</th>
<th>RMS Absolute error</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.00 - 19.99</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
</tr>
<tr>
<td>20.00 - 21.99</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
</tr>
<tr>
<td>22.00 - 23.99</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
</tr>
<tr>
<td>24.00 - 25.99</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
</tr>
<tr>
<td>26.00 - 27.99</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
</tr>
<tr>
<td>28.00 - 30.00</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
</tr>
<tr>
<td>Mean power 1.41 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
<td>0.25 D</td>
</tr>
</tbody>
</table>

© Dr. Hill (http://doctorhill.com/iol-main/formulas.htm) / 02.05.09
Will LENSTAR measure through dense mature cataracts? - The DCM Mode

- LENSTAR requires to detect the infra-red energy reflected from the retina to make measurements.
- If the cataract is too dense then it will absorb the energy from the instrument.
- LENSTAR uses a Super Luminescent Diode of 820nm and this in theory has better penetrative powers than the 780 Semiconductor Diode used in IOL Master.
- Automatic recalculation in cases where axial length measurement is difficult.
- Significant improvement in the measurement ability in Grade 3 cataract and PSCs.

Comparison IOL Master & LENSTAR

<table>
<thead>
<tr>
<th>Zeiss</th>
<th>LENSTAR</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keratometer</td>
<td>5 points at 12 points</td>
<td>40 points in two circumferential zones 40mm &amp; 2mm</td>
</tr>
<tr>
<td>Biometer</td>
<td>Partial Corneal Interferometry Axial Length (4A)</td>
<td>Optical Low Coherence Reflectometry Central Corneal Thickness (CCT) Anterior Chamber Depth (ACD) Lens Thickness (LT) Retinal Thickness (RT) Axial Length (4A)</td>
</tr>
<tr>
<td>Anterior Chamber Depth Mode</td>
<td>No – separate mode</td>
<td>Estimated in true ACD is provided automatically with each measurement.</td>
</tr>
<tr>
<td>Pachymeter</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

LENSTAR is based on OLCR technology and has proven to have excellent correlation. IOL Master assumes a CCT.

Additional LENSTAR can give a value for the eccentricity of fixation relative to the pupil and limbus.

Currently, the longer wavelength of LS should have a better ability to penetrate mature cataract. Currently under investigation.

Comparison IOL Master & LENSTAR

<table>
<thead>
<tr>
<th>Zeiss</th>
<th>LENSTAR</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>White to White</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Pupillometer</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Additionally, LENSTAR can give a value for the eccentricity of fixation relative to the pupil and limbus.

Measurement Range

<table>
<thead>
<tr>
<th>Zeiss</th>
<th>LENSTAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCT NA</td>
<td>0.300 - 0.800mm</td>
</tr>
<tr>
<td>ACD 1.65mm - 6.5mm</td>
<td>1.5mm - 6.5mm</td>
</tr>
<tr>
<td>K 0.5 - 10.5mm</td>
<td>0.5 - 10.5mm</td>
</tr>
<tr>
<td>Pupil 2 - 13mm</td>
<td>Pupil 2 - 13mm</td>
</tr>
</tbody>
</table>

In theory, the longer wavelength of LS should have a better ability to penetrate mature cataract. Currently under investigation.
Olsen Formula

- Multi-variable formula that considers lens thickness as an important factor
- Ray tracing
- Increased accuracy in predicting post-operative IOL position
- C-Constant- to describe the physical position of the IOL in the eye.
- It can be thought of as a ratio by which the empty capsular bag will encapsulate and fixate an IOL following in-the-bag implantation.
- This approach predicts the IOL position as a function of preoperative anterior chamber depth and lens thickness.
- Improved surgical outcomes

'T-Cone'

- Corneal Topography Module
- Providing additional corneal data
- Improved TORIC IOL planning
- Increased Safety
- Detection of irregular astigmatism
- Demonstrate previous corneal refractive surgery
- Confirm visual axis location
- Screen for corneal disease

THANK YOU