The Effects of Treating Dry Eye on Optical Biometry and IOL Selection

Benjamin Cheung O.D.

Disclosures

I have no financial disclosures or conflicts of interest with the presented material in this presentation.

17,200,000 Americans Diagnosed with Clinical Dry Eye

24,410,000 Prevalence of Cataracts in 2010

Expected to double by 2050

PHACO Study

76.8% of patients in the study were positive for fluorescein staining

<80% of the patients had a TBUT of ≤7 seconds (Trattler et al. 2017)

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Optical Biometry

Axial Length

Keratometry

Anterior Chamber Depth

IOL Master

With modern optical biometry, refractive outcomes of more than 90% of patients are within ±1 D and more than 60% of patients are within ±0.5 D of target (Sheard, 2014)

Dry Eye

“Multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film and accompanied by ocular symptoms in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles.”

PHACO Study

76.8% of patients in the study were positive for fluorescein staining

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Testing to aid in the Diagnosis and Management of Dry Eye

1. **SPEED Questionnaire**
2. **Tear Osmolarity**
3. **Inflammadry Testing**

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Dry Eye Treatment

- Artificial Tears
- Anti-inflammatory
  - Immunosuppressants
  - Steroids
- Lid Hygiene
- MGD Treatment
- Punctal Plugs
- Scleral Lenses
- Amniotic Membranes

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Effect of Tear Osmolarity on Repeatability of Keratometry for Cataract Surgery Planning

- The hyperosmolar group had:
  - Higher variability in the average K reading than the normal group
  - Higher percentage of eyes with a 1.0 diopter or greater difference in the measured corneal astigmatism
  - Higher percentage of eyes had an IOL power difference of more than 0.5 diopter

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Causes and Correction of Dissatisfaction after Implantation of Presbyopia-Correcting Intraocular Lenses

- An impaired ocular surface can adversely affect pre-operative planning.
- Dry eye will impair healing and visual recovery.
- Study reports that 30% of patient dissatisfaction was related to dry eye after surgery.

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The Effect of Lifitegrast on Refractive Accuracy and Symptoms in Dry Eye Patients Undergoing Cataract Surgery

- Treatment resulted in improved accuracy of anterior corneal power measurements, predicting postoperative SE refractive error and ultimately resulting in better postoperative outcomes.
- Treatment was found to also significantly reduce HOAs in the central 6.0 mm of the cornea.

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In-house study

<table>
<thead>
<tr>
<th>Inflammadry Testing</th>
<th>Tear Osmolarity</th>
<th>SPEED Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualified with Grading System</td>
<td>Normal Range: 275-307 mOsm/L</td>
<td>Symptomatic: &gt;6</td>
</tr>
<tr>
<td>Faint Positive: 1</td>
<td>Above range: ≥ 400 mOsm/L</td>
<td></td>
</tr>
<tr>
<td>Positive: 2</td>
<td>Below Range: ≤ 275 mOsm/L</td>
<td></td>
</tr>
<tr>
<td>Strong Positive: 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Keratometry</th>
<th>Corneal Cylinder</th>
<th>Recommended IOL Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOL master</td>
<td>ITrace topographer</td>
<td>ITrace topographer</td>
</tr>
<tr>
<td>Projected spherical equivalent</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results: Dry Eye Testing

**Inflammadry Testing**
- Ordinal
  - OD: No significant difference
  - OS: Significant difference
  - Signed Rank Test Value: 0.090

**Tear Osmolarity**
- OD: No significant difference
  - Mean difference: -0.074
  - Paired T-Test Value: 0.456
- OS: No significant difference
  - Mean difference: -3.037
  - Paired T-Test Value: 0.541

**SPEED Questionnaire**
- OD: No significant difference
  - Mean difference: -3.457
  - T-Test Value: 0.0001
  - Signed Rank Test Value: 0.001
- OS: No significant difference

Results: Average Keratometry

**OD/ITrace**
- No significant difference
  - Mean difference (ITrace): 0.003
  - Paired T-Test Value (ITrace): 0.9525

**OS/ITrace**
- No significant difference
  - Mean difference (ITrace): 0.081
  - Paired T-Test Value (ITrace): 0.143

**OD/ IOL Master**
- No significant difference
  - Mean difference (IOL): 0.023
  - Paired T-Test Value (IOL): 0.553

**OS/ IOL Master**
- Significant difference
  - Mean difference (IOL): 0.069
  - Paired T-Test Value (IOL): 0.015

Results: Corneal Cylinder

**OD/ITrace**
- Significant difference
  - Mean difference (ITrace): 0.1667
  - Paired T-Test Value (ITrace): <0.0001

**OS/ITrace**
- Significant difference
  - Mean difference (ITrace): 0.175
  - Paired T-Test Value (ITrace): <0.0001

**OD/ IOL Master**
- Significant difference
  - Mean difference (IOL): 0.345
  - Paired T-Test Value (IOL): <0.0001

**OS/ IOL Master**
- Significant difference
  - Mean difference (IOL): 0.207
  - Paired T-Test Value (IOL): <0.0001

Results: Recommended IOL Power

**OD**
- No significant difference
  - Mean difference: -0.023
  - Paired T-Test Value: 0.823

**OS**
- No significant difference
  - Mean difference: -0.0118
  - Paired T-Test Value: 0.207

In-house Study: Recommended IOL Power

Example of a Stable Scan
### Results: Projected Spherical Equivalent

<table>
<thead>
<tr>
<th>Eye</th>
<th>Condition</th>
<th>Difference</th>
<th>Paired T-Test Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD</td>
<td>Stable Scan</td>
<td>0.17</td>
<td>0.523</td>
</tr>
<tr>
<td>OS</td>
<td>Stable Scan</td>
<td>0.17</td>
<td>0.523</td>
</tr>
<tr>
<td>OD</td>
<td>Unstable Scan</td>
<td>0.17</td>
<td>0.523</td>
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### Factors that can cause Post-Operative Dry Eye

- Transection of Corneal Nerves
- Frequent irrigation of the cornea
- Use of topical anesthesia and antibiotics
- Phototoxic damage from the microscope light
- Elevation of inflammatory factors in the tear film
- Postoperative use of NSAIDs

### Incidence and pattern of dry eye after cataract surgery (Kasetsuwan et al. 2013)

- Cataract surgery is shown to decrease:
  - OSDI score
  - TBUT
  - Schirmer I score
  - Mean goblet cell density
  - Corneal sensitivity at the corneal center and temporal incision site.

### What we have learned

- Reduce surgical difficulty
- Measurements
  - IOL Power
  - Toric Magnitude and Axis
- Post-operative
  - Optimize visual healing and recovery
  - Reduce postoperative dry eye
  - Increase patient satisfaction
Study Limitations

- Sample Size
  - Tear Osmolarity, Inflammadry
- Compliance
- Observational study
  - no age-matched control subjects
  - no unmasked investigators
- Limited Exclusion Criteria
  - included all symptomatic patients, without differentiating different sources of dry eye

References


THANKS!

Any questions?
You can find me at
  ▹ benjamincheung20@neco.edu