Correlation of Patient Characteristics and High Order Aberrations

K. Ashley Tuan, OD, PhD, FAAO
George Dai, PhD, FAAO
HOA and patient characteristics

- Ethnicity?
- Gender?
- Age?
- Manifest Refraction?
- Corneal Curvature?
- Corneal Astigmatism?
Data Source

453 eyes from US and Asia
Wavefront Measurements

- All WF diameter 5mm or larger
- Normalized to 5mm

VISX WaveScan®
- 6-order Zernike polynomials
- Multiple exams taken at each visit
Ethnicity

- Caucasian: 57% (257)
- Aisan: 38% (173)
- Other: 5% (23)
Gender

M (214) 47%
F (239) 53%
Age

33.9 ± 7.7 (19-56)
Sph -3.93 ± 2.21 (+2.00 to -10.75)
Cyl -0.83 ± 0.80 (0 to -4.00)

MRSE

-10  -8  -6  -4  -2  0  2

4.7%  9.1%  19.3%  35.0%  29.3%  2.4%  0.2%

0%  10%  20%  30%  40%  50%
ave K

43.74 ± 1.74 D (36 to 49)
Results
Multiple Regression on Ocular Total HOA

- Ethnicity: Significant (p ≤ 0.01)
- Gender: Not Significant (p > 0.05)
- Age: Not Significant (p > 0.05)
- Manifest Refraction: Not Significant (p > 0.05)
- Corneal Astigmatism: Significant (p ≤ 0.01)
- Corneal Curvature: Not Significant (p > 0.05)
Major Contributor to HOA: Ethnicity

Wavefront High Order Aberrations

Caucasian

P<0.01

Asian
Total HOA RMS

Caucasian: $0.14 \pm 0.05$

Asian: $0.18 \pm 0.07$
### Individual HOA

**Multivariate Regression**

<table>
<thead>
<tr>
<th>Zernike Term</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Significant Predictor</td>
<td>Race</td>
<td>Race</td>
<td>Race</td>
<td>-</td>
<td>Race</td>
</tr>
<tr>
<td>Second Significant Predictor</td>
<td>dK</td>
<td>Age</td>
<td>-</td>
<td>-</td>
<td>dK</td>
</tr>
<tr>
<td>Third Significant Predictor</td>
<td>MRS</td>
<td>MRS</td>
<td>-</td>
<td>-</td>
<td>K</td>
</tr>
</tbody>
</table>

Ethnicity is the major predictor for most HOA Zernike terms.
Ethnicity: logistic regression

Astigmatism

Corneal Astigmatism

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Astigmatism</th>
<th>P-value</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asians</td>
<td>0.69 ± 0.51</td>
<td>&lt;0.01</td>
<td>14.6x</td>
</tr>
<tr>
<td>Caucasians</td>
<td>1.37 ± 0.76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Manifest Astigmatism

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Astigmatism</th>
<th>P-value</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asians</td>
<td>0.64 ± 0.66</td>
<td>&lt;0.01</td>
<td>156x</td>
</tr>
<tr>
<td>Caucasians</td>
<td>1.14 ± 0.91</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Asians may have more lenticular astigmatism.
Ethnicity: logistic regression

Corneal Curvature

Steeper Cornea

P<0.01
OR = 1.6X

44.07 ± 1.51

Flatter Cornea

43.34 ± 1.98
HOA and Patient Characteristics

- Ethnicity?
- Gender?
- Age?
- Manifest Refraction?
- Corneal Curvature?
- Corneal Astigmatism?
HOA and Patient Characteristics

- Ethnicity?
- Gender? (Circled)
- Age?
- Manifest Refraction?
- Corneal Curvature?
- Corneal Astigmatism?
Conclusion

- HOA increases with age
- HOA correlates with patient ethnicity (Caucasian vs Asian)
  - Asians are more likely to have higher total HOA RMS.
  - Among the two groups, Asians tend to have flatter corneal curvature, more corneal & manifest astigmatism
US Population / (European)  US LASIK Treatment

Asian Population

Large proportion of global treatments
Thank you