Customized Cataract Surgery

Paul H. Ernest, M.D.

Definition

- Customized cataract surgery is a detailed process
- Matching lens technology to a patient’s individual lifestyle.
- Involves an understanding of the MTF’s of each lens at various focal points. Also involves analysis of the defocus curves of each lens.
- Need a screening process to determine what activities your patient does and how much time your patient spends doing them.

Customized Cataract Surgery is NOT just using Multifocal Lens Implants

- Some patients lifestyle are not well suited for multifocal lens implants
- Patients who do qualify for multifocal lenses are still offered a monofocal lens implant with discussion of insurance coverage
- Performed 2,342 cataract surgeries in 2018
  - Only 1 in 5 received a multifocal or EDOF lens
  - 4 in 5 received either a monofocal or monofocal toric lens

Pre-Op Evaluation

- Thorough ocular evaluation to detect conditions other than cataracts (ERM, ION, Glaucoma, Fuchs’ Corneal Dystrophy, ARMID, ARMD, DES)
- Refractive error and corneal astigmatism
- OPD Wavescan III
  - Confirms corneal astigmatism
  - Corneal coma
  - Red flag: r>0.22 microns – contraindication for multifocal lenses
  - Placebo disc – dry eye
  - Monopix pupil size
    - Yellow flag – pupils > 6 mm will have more side effects from multifocal lenses

Evaluation of Patient Lifestyle

- Discuss Buckets
- Discuss “Time”

Evaluation of Patient Lifestyle

Discuss with each patient the concept of a limited amount of M&M candies being distributed between 3 buckets.
Evaluation of Patient Lifestyle

- Pre-op refractive error
  - -1.25 D -> -1.50 D
  - -2.00 D -> -2.50 D
- Does this patient like to remove glasses to use computer or read?
  - If "YES" be very careful about recommending multifocal lenses

Current Intraocular Lenses

**Monofocal / Monofocal Toric**

- Distance
- Intermediate
- Near

Current Intraocular Lenses

**Multifocal Lenses - ReSTOR 3.0 / Technis Multifocal**

- Distance
- Intermediate
- Near

Current Intraocular Lenses

**Depth-of-Focus Lenses – ReSTOR 2.5 & Symfony**

- Distance
- Intermediate
- Near

Current Intraocular Lenses

**Trifocal – PanOptix**

- Near
- Intermediate
- Distance

Questions?
Matching Technology with Lifestyle

• Based on what a patient does in each bucket and how much time spent in each bucket – can match technology with patient’s individual lifestyle.

• Example:
  • Patient with an active outdoor lifestyle
  • Majority of the time he is in the distance bucket (hunting, golfing, farming)
  • Moderate amount of time in the middle bucket (computer)
  • Little time in the near bucket (reading)

• Recommended Technology
  • Bilateral ReSTOR 2.5 Lenses

Matching Technology with Lifestyle

• Example:
  • Patient spends majority of the time in the middle bucket
  • Works most of the day on the computer, enjoys crafts – quilting, wood working, likes to cook
  • Next active bucket is distance – driving, walking, gardening
  • Least active bucket - Near

• Recommended Technology:
  • Bilateral Symfony Lenses

Matching Technology with Lifestyle

• Example:
  • Patient spends majority of the time in the middle bucket
  • Time spent in the distance and near buckets are similar

• Recommended Technology:
  • Bilateral Symfony Lenses with modified mono-vision
  • Non-dominant eye target -0.50 D -> -0.75 D

Matching Technology with Lifestyle

• Example:
  • Patient very active in distance and middle buckets
  • Active outdoors on weekends and summers (golf, boating, hunting)
  • Busy on a computer and desk work during weekdays

• Recommended Technology:
  • Dominant eye - ReSTOR 2.5 Lens
  • Non-dominant eye – Symfony Lens
  "Mix and Match"

Matching Technology with Lifestyle

• Example:
  • Majority of time in distance bucket
  • Equal amount of time in the middle and near buckets

• Recommended Technology:
  • Dominant Eye - ReSTOR 2.5
  • Non-dominant eye – Technis Multifocal or ReSTOR 3.0

Matching Technology with Lifestyle

• Example:
  • Majority of the time in the distance bucket
  • Very little time in the middle bucket

• Recommended Technology:
  • Bilateral Monofocal Lenses – set for emmetropia
  • Reading glasses
  • If a patient is not doing much activity in the middle bucket they do not need advanced technology lenses
Matching Technology with Lifestyle

• Example:
  • Equal amount of time in all three buckets
  • Very active in all three buckets

• Recommended Technology:
  • Bilateral PanOptix Lens

Matching Technology with Lifestyle

• Example:
  • Patient wears contacts in monovision format

• Recommended Technology:
  • Maintain monovision using multifocal lenses
    • One eye for distance
    • Other eye for near (-2.00 D)
    • Correct pre-existing astigmatism

Matching Technology with Lifestyle

• Example:
  • Patient wears bilateral multifocal contact lenses

• Recommended Technology:
  • Match the implant technology to the contact lens technology
  • Need to know if patient needs supplemental reading glasses in addition to their multifocal contact lenses

Questions?

Astigmatism Control

• Target post-op astigmatism 0.50 D or less
• Use femtosecond laser or toric lenses

Reduction of Higher Order Aberrations
Coma

Higher Order Aberrations in Femtosecond Laser-Assisted Versus Manual Cataract Surgery: A Retrospective Cohort Study

Recent publications have shown no statistical difference regarding refractive error or uncorrected vision between FLACS and MCS.

Study Parameters

- Evaluate patients with TECNIS Symfony (Johnson & Johnson Vision, Santa Ana, CA) and AcrySof IQ ReSTOR +2.50 D (Alcon Laboratories, Inc.) lenses into two groups:
  - With femtosecond laser / without femtosecond laser
  - Data collected 2-14 months post-op using the Marco OPD-Scan III
- Excellent quality of surgery for each group
- Evaluate centration of lens with regards to visual axis (angle alpha, angle kappa)
- Evaluate internal coma of both study groups
- Evaluate refractive error and visual acuity
- Standardized patient satisfaction questionnaire for each patient
- Statistical analysis of results

Study Findings

No difference between femtosecond and manual cataract surgery group

- Angle Alpha and Angle Kappa
- UCVA and BCVA
- Post-op refractive error

Statistical Analysis

<table>
<thead>
<tr>
<th>Study Parameters</th>
<th>Femtosecond</th>
<th>Manual Cataract</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Femto</td>
<td>Non-Femto</td>
</tr>
<tr>
<td>Range</td>
<td>0.029-0.206</td>
<td>0.029-2.052</td>
</tr>
<tr>
<td>AVG</td>
<td>0.109</td>
<td>0.735</td>
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</table>

<table>
<thead>
<tr>
<th>Internal Coma</th>
<th>FLACS n=57</th>
<th>MCS n=50</th>
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<tbody>
<tr>
<td>Range</td>
<td>0.019-0.206</td>
<td>0.029-0.728</td>
</tr>
<tr>
<td>AVG</td>
<td>0.109</td>
<td>0.141</td>
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</tbody>
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Outliers

Internal coma ≥ 0.400 microns
Study Findings Internal Coma – Outliers

- 0.7 microns of internal coma
- 1 clock hour of asymmetrical overlap of anterior capsule on the optic surface
- 1.662 microns of internal coma
- 3 clock hours of asymmetrical overlap of anterior capsule on the optic surface
- 2.05 microns of internal coma
- 4 clock hours of asymmetrical overlap of anterior capsule on the optic surface
- 0.728 microns of internal coma
- Split of anterior capsule

Study Findings Internal Coma

- 0.023 microns of internal coma

Scatterplot of the Relation between Mesopic Pupil Size and Internal Coma

Compare Patient with Low Internal Coma with Patient with High Internal Coma

- Day vision low coma
- Day vision high coma

Compare Patient with Low Internal Coma with Patient with High Internal Coma

- Night vision low coma
- Night vision high coma

Does the increase in internal coma impact patient satisfaction?
Study Findings
Patient Satisfaction Survey Scores

- Patients were asked 30 questions from 10 categories with responses ranging from 0-3
  - 0: Not a problem
  - 1: Mild
  - 2: Moderate
  - 3: Severe

- 10 Categories Include
  - Glare
  - Haloes
  - Starburst
  - Hazy Vision
  - Blurred Vision
  - Distortion
  - Multiple Images
  - Fluctuation in vision
  - Focusing difficulties
  - Depth perception

Comparison of satisfaction score and internal coma less than 0.20 microns

<table>
<thead>
<tr>
<th>Satisfaction Score</th>
<th>% of People with Internal Coma of 0.20 µ or less</th>
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</thead>
<tbody>
<tr>
<td>0-10 (n=15)</td>
<td>100%</td>
</tr>
<tr>
<td>11-20 (n=29)</td>
<td>93.1%</td>
</tr>
<tr>
<td>21-30 (n=30)</td>
<td>60%</td>
</tr>
<tr>
<td>&gt;30 (n=15)</td>
<td>46.7% (p&lt;0.001)</td>
</tr>
</tbody>
</table>

- There is a direct correlation between the overlap of the anterior capsule on the optic and higher order aberrations (internal coma)
- The more symmetrical the overlap of the anterior capsule on the optic, the lower the internal coma
- The Femtosecond laser gives a more symmetrical overlap of the anterior capsule on the optic (p<0.05)
- Internal coma affects the quality of patients’ vision under mesopic conditions especially with multifocal lenses (satisfaction survey)

Management of the Unhappy Patient

- Patient Selection
  - Unrealistic expectations
  - Disconnect between level of cataract and symptoms
  - Patients that are very difficult to please

- Corneal Surface
  - Multifocal and EDOF lenses require good corneal surface
  - Tear plugs, hourly artificial tears, artificial tear gel or ointment at bedtime
  - Restasis or Xidra
  - Residual astigmatism
  - PRK 90 days post-op after intensive corneal surface treatment fails
  - PLEASE do not prescribe astigmatic, bifocals, or progressive glasses in patients with multifocal or EDOF lenses

- Halos:
  - 1% pilocarpine eye drops TID
  - Use for 1 month then taper

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Screening Process

Current Lenses:
- Monofocal
- Toric
- Depth-of-focus - ReSTOR2.5
- Symfony

New Lenses
- PanOptix Lens
- Trifocal Lens

Pre-op Workup
- OPD Wavescan
- Pentacam
- Biometry IOL Master 700 Series

Astigmatism Control
Goal: Post-op Astigmatism of 0.50 D or Less
- Femtosecond laser
- Toric Lens

Reduction of HOA
- Femtosecond laser
- Centration of Lens
Especially Multifocal, Depth-of-focus Lens, Toric, Trifocal lenses

Managing the Unhappy Patient
- Corneal Surface
- Residual Astigmatism
- PRK
- Resutal - Pilocarpine
- Customized Cataract Surgery Process

Questions?