Subjective Assessment of Accommodation and Extended Depth of Focus (EDF)

Surgeon Expectations

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2014
Consultant for:

- Abbott Medical Optics: C
- Calhoun Vision Inc: O
- Clarity: C,O;
- Powervision: C, O
What do patients want?
Reduced Spectacle Dependence?

1. 10% - like wearing glasses
2. 10% - limited BCVA
3. 15% - hate glasses
4. 2/3 – interested but depends on cost/tradeoffs

Based on clinical experience
What do patients want? OPTIONS!

Reduced Spectacle Dependence

1. Good "quality" vision
2. Minimal unwanted images (tradeoff)
3. Low risk
4. Affordable
Percent of current cataract procedures that involve presbyopia-correcting IOLs

- 0%: None
- 1% to 5%
- 5% to 10%
- 11% to 20%
- 21% to 40%
Percent of current cataract procedures that involve presbyopia-correcting IOLs

- None: 23.4%
- 1% to 5%: 14.5%
- 5% to 10%: 19.5%
- 11% to 20%: 10.7%
- 21 to 40%: 32.0%
Average % of cataract procedures that is presbyopia-correcting IOLs is 7.9% (7% US, 9% Non-US)

Average % targeted for monovision = 18.9% (15.2% US, 23.1% Non-US)

ASCRS 2013 Survey
High Satisfaction

Mono – better intermediate

MF – better near

MF – more dysphotopsia
Average % of cataract procedures that is presbyopia-correcting IOLs is 7.9% (7% US, 9% Non-US)

Average % targeted for monovision = 18.9% (15.2% US, 23.1% Non-US)
Multifocal IOL Limitations
(1997 Array FDA approval)

1. Cost
2. Intermediate not optimized
3. Halos/unwanted images
4. Contrast sensitivity loss
   1. Ocular co-morbidity
   2. Residual refractive error
1. Reduced dependence vs independence
2. Intermediate vs near
3. Accommodating vs pseudoaccommodating?
4. Optical risks? Corrected with spectacles? Permanence?
5. Options – individualize (cost/tradeoffs)

Based on clinical experience
1. Reduced dependence vs independence
2. Intermediate vs near
3. Accommodating vs pseudoaccommodating?
4. Optical risks? Corrected with spectacles? Permanence?
5. Options – individualize (cost/tradeoffs)

Based on clinical experience
Reduced spectacle dependence vs independence

1. Social vs occupational vision
2. Lifestyle
3. Most patients willing to wear glasses for certain tasks
1. Reduced dependence vs independence
2. Intermediate vs near
3. Accommodating vs pseudoaccommodating?
4. Optical risks? Corrected with spectacles? Permanence?
5. Options – individualize (cost/tradeoffs)

Based on clinical experience
Intermediate vs near

1. Computer, mobile devices
2. Dashboard
3. ReSTOR 4.0 versus 3.0
Patient Desire / Satisfaction

1. Reduced dependence vs independence
2. Intermediate vs near
3. Accommodating vs pseudoaccommodating?
4. Optical risks? Corrected with spectacles? Permanence?
5. Options – individualize (cost/tradeoffs)

Based on clinical experience
Accommodating vs pseudoaccommodating

1. Mechanism not important to patients
2. MDs – want to understand
3. Mechanism
   1. Static – few long term questions
   2. Dynamic – long term questions
Patient Desire / Satisfaction

1. Reduced dependence vs independence
2. Intermediate vs near
3. Accommodating vs pseudoaccommodating?
4. Optical risks? Corrected with spectacles? Permanence?
5. Options – individualize (cost/tradeoffs)

Based on clinical experience
Optical risks/trade-offs?

1. Halos, higher order aberrations
2. Correctable with spectacles
3. IOL Exchange
Patient Desire / Satisfaction

1. Reduced dependence vs independence
2. Intermediate vs near
3. Accommodating vs pseudoaccommodating?
4. Optical risks? Corrected with spectacles? Permanence?
5. Options – individualize (cost/tradeoffs)

Based on clinical experience
Options – individualize

1. Motivation for spectacle independence
2. Ocular co-morbidity
3. Refractive error (e.g. astigmatism)
4. Optical trade-offs – risk tolerance
MD Expectations for Approval

1. **Accommodating**
   1. Range
   2. Long term follow-up
2. **Pseudo-accommodating**
   1. DOF, intermediate
   2. Binocular results
3. **Safety**
   1. Ocular
   2. Optical
4. **Efficacy**
   1. Subjective vs objective
MD Expectations
Pseudo-accommodating

1. Static Mechanism
   1. Optical Bench Testing important
   2. Clinical testing - confirm
   3. Control – necessary?

2. Dynamic Mechanism
   1. Clinical testing more important
   2. Longer follow-up

Based on clinical experience
Defocus curves methods inconsistent need standardization (targets & acceptable VA)

Gupta N, Wolffshon JSW, Naroo SA
Optimizing measurement of subjective amplitude of accommodation with defocus curves.
J Cataract Refract Surg 2008;34:1329-1338
Objective accommodation measurements in pseudophakic subjects using an autorefractor and an aberrometer.

Dorothy M. Win-Hall, OD, Adrian Glasser, PhD

PURPOSE: To compare objective measures of accommodation with the WR-5100K autorefractor and iTrace aberrometer to subjective push-down and defocus tests in normal phakic subjects and pseudophakic subjects with standard monofocal intraocular lenses (IOLs).

SETTING: University of Houston, College of Optometry, Houston, Texas, USA.

METHODS: The push-down test and defocus curves were used to stimulate and measure accommodation subjectively in pseudophakic subjects. For objective testing, a near target was pushed up and retraction measured objectively. For comparison, the same objective measurements were performed in phakic subjects. Calibration tests were performed with soft contact lenses in phakic subjects with varying refractive error and in pseudophakic subjects.

RESULTS: Fifteen phakic subjects (mean age 28.9 years ± 5.52 [SD]) and 10 pseudophakic subjects (mean age 66.2 ± 11.23 years) participated. Subjectively measured accommodative amplitude in the pseudophakic group was 3.28 ± 1.11 diopters (D) in the right eye and 3.64 ± 1.38 D in the left eye. Defocus curves in the pseudophakic group had a range of 2.90 D for distance-corrected visual acuity of 20/20 or better. Objective measurements in the pseudophakic group were 0.11 ± 0.50 D with the autorefractor and 0.10 ± 0.47 D with the aberrometer. Contact lens calibrations showed good agreement with the 1:1 line.

CONCLUSIONS: The subjective tests overestimated accommodative amplitude relative to the objective measures. The autorefractor and aberrometer were accurate, reliable, and appropriate for objective accommodation measurements in pseudophakics. Objective accommodation measurements such as these can be used to evaluate the performance of accommodating IOLs.


Win-Hall DM, Glasser A

Objective accommodation measurements in pseudophakic subjects using an autorefractor and an aberrometer.

Salzburg Reading Desk
**iTrace (Tracey)**

estimation of DOF using measured HOA

Plot of DOF vs contrast

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Increase in spherical aberration increases DOF ... but with corresponding decrease in contrast

(young phakic patient)
Adaptive Optics (AO) IOL Optical Bench Testing System
Objective evaluation of through-focus optical performance of presbyopia-correcting intraocular lenses using an optical bench system

Myoung Joon Kim, MD, Len Zheleznyak, MS, Scott MacRae, MD, Hungwon Tchah, MD, Geunyoung Yoon, PhD

Spherical Monofocal vs Premium IOL’s

Pupil = 3.0 mm

Distance: Beyond → Near ⇒

Intermediate:

-0.5D 0D +0.5D +1.0D +1.5D +2.0D +2.5D +3.0D +3.5D +4.0D +4.5D
Astigmatism Reduces Multifocal IOL Depth of Field
Scott MacRae, M.D.

Premium IOLs do not exhibit an extended DoF as compared to monofocal IOLs in the presence of corneal astigmatism ≥ 0.5D.
Patient Acceptance of Safety – Efficacy

1. Safety?
2. Optical tradeoffs?
3. Label?
4. Patient satisfaction?