

Treatment Options for Cataracts

Richard Stewart, MD, MSPH

Insight Vision Group

303-578-3556



Boulder Community Health



INSIGHT VISION GROUP

Financial Disclosures

- No financial relationships to disclose

Eye: Basic Anatomy

- 4 basic layers of the eye:
 - Cornea
 - Lens
 - Retina
 - Optic Nerve

Refractive Error

- **Myopia/"Near" Sightedness**
 - Requirement of glasses from an early age
 - Eye is too long
 - If severe, may be prone to retinal detachments/degenerations
- **Hyperopia/"Far" Sightedness**
 - Glasses often not required until 30' s/40' s
 - Eye is too short
 - If severe, may be more prone to glaucoma

What is Astigmatism?

- Asymmetry in the visual axis
- Results in “warping” of images like a funny mirror
- 1 in 3 people have visually significant astigmatism

Refractive Error

- **Presbyopia**
 - Age-related inability to focus native lens due to age-related changes to the MUSCLE which helps focus objects when reading and in close proximity
 - Onset at 40-45 years of age
 - Has to do with normal aging and is NOT purely anatomic
 - Treatment options:
 - Bifocals
 - Progressive eyeglasses
 - “Monovision” contact lenses or Refractive Surgery
 - CK
 - Intraocular surgery if visually significant cataracts are also present

Refractive Error: Summary

- **Myopia:** cannot see distance
- **Hyperopia:** cannot see near or distance
- **Astigmatism:** distortion at all distances
- **Presbyopia:** difficulty seeing up close to reading or do computer work

Eye: Basic Anatomy

- 4 basic layers of the eye:
 - **CORNEA**
 - Lens
 - Retina
 - Optic Nerve

LASIK/PRK/Refractive Surgery

- Compensates for astigmatism, near-, or far-sightedness by changing the corneal surface
- Accomplishes this through use of a precise excimer laser to revise tissue
 - surgery is all external, is typically done in a physician's office, and often yields significant results quickly
- Goal: to reduce spectacle dependence in people who have traditionally needed glasses to see objects at a distance
- Realistic Expectations:
 - does NOT necessarily eliminate the need for reading glasses
 - is not recommended for anybody with cataracts until AFTER the cataract is addressed
 - requires a complete eye examination by an ophthalmologist to determine candidacy for the procedure

LASIK/Refractive Surgery

- Laser is applied to the internal surface of the cornea to steepen or flatten it
- Healing time is generally quick because of very limited trauma to the eye

LASIK + Cataract Surgery = Refractive Cataract Surgery

- Addressing patients needs by simultaneously treating cataracts AND refractive error (near/far sighted) at the same time

Eye: Basic Anatomy

- 4 basic layers of the eye:
 - Cornea
 - **LENS**
 - Retina
 - Optic Nerve

Cataracts

- Definition: progressive clouding of the native “crystalline” lens

Cataracts: Information

- Common cause of blindness worldwide
- Is often a NORMAL aging process which affects virtually everybody at some point in their lives
 - Some degree of cataract can be detected in all adults past middle age
- Typically becomes problematic in the 6th-7th decade of life
 - affects 50% of people 65-74 years of age
 - affects >70% of people over 75 years of age
- Is TREATABLE with medical therapy

Cataracts: Symptoms

- Progressive blurriness of vision
- Failure to pass driver’s examination
- Impairment of color vision
- Difficulty seeing at night or in dimly lit environments
- Changes to your existing prescription (stronger glasses) which still do not provide optimal vision
- Glare, haloes, and/or double vision
- Patients often describe “blur,” “fog,” or “smudged” vision

Cataracts: Diagnosis

- Complete ophthalmic examination required to evaluate the condition of the lens and the stage of the cataract
- Attempts at correcting visual acuity with a change in glasses
- Attention to lifestyle issues, such problems with glare and ghosting of images

Cataracts: Treatment

- Cataract can be removed and replaced with a transparent artificial lens if:
 - The cataract has become visually significant
 - It is interfering with a person's lifestyle
 - The individual wants to optimize their visual potential, improve their color perception, and reduce glare and/or haloes
 - Cataract poses occupational hazard (i.e., pilot, CDL)

Cataracts: Treatment

- Surgery is quick, usually painless, and is performed without admission to the hospital
- Does **not** require general anesthesia
- Utilizes ultrasound *or* laser to break the cataract apart and gently remove it
- Allows the physician to implant a lens within the eye which may limit or possibly eliminate the need for glasses and/or contact lenses
- Generally allows a patient to typically return to normal activities in about 1 week
- Well tolerated procedure that often takes less than 20 minutes

Cataract Surgery: 4 Critical Steps that Affect Outcomes

- Incisions:
 - Size
 - Depth
 - Shape
 - Configuration
- Capsulorhexis
 - Size
 - Shape
- Lens Selection
 - Monofocal, Multifocal, Accommodative, Toric
- Lens Placement
 - Depth
 - Orientation

Cataract Surgery: Economics

- 2005:
 - Medicare ruling permitted patients to select specialty lenses without having to relinquish their overall surgical coverage benefits
 - Opened the door for patients to select premium lenses and services should they so desire
- 2007:
 - Toric IOL's added to the provision
- Medicare perspective: cataract surgery *is* medically necessary, but the decision to pursue spectacle-free vision is *not* medically necessary
 - Cataract – services ARE covered
 - Refraction – services ARE NOT covered
- Result: additional costs incurred in providing patient a particular refractive outcome is the responsibility of the patient

Cataracts: Choices

- **Measurements:**
 - Keratometry/A Scan (Preoperative)
 - Optical: IOL Master™/LenStar™ (Preoperative)
 - Intraoperative: ORA® (Optiwave Refractive Analyzer)
- **Technique:**
 - ECCE
 - Phacemulsification
 - Femtosecond Laser
- **Lens:**
 - Monofocal
 - Multifocal
 - Toric
 - Accommodative
 - Accommodative Toric

Measurements

- The anatomy of the eye dictates a particular lens power, type, and orientation
- Measurements are unique to each eye
- Conventional measurements use 2 variables:
 - Axial Length: Optical vs. U/S
 - Keratometry
- Variables can then put into a variety of formulas

SEC: “Standard” Measurements

- “Standard” Measurements for surgery:
 - Manual Keratometry
 - ARK/Autokeratometry
 - Manual Refraction
 - Pentacam
 - Immersion A Scan
 - Optical A Scan: IOL Master™/LenStar™
- *In addition*, we track our post-op results to continue to improve accuracy

Limitations of Conventional Measurements

- Problems with measurements:
 - Cataract itself blocks scanning abilities
 - Not all corneas behave as predicted
 - Not all anatomy fits any one formula
- Accuracy decreases with:
 - High myopia, hyperopia, or astigmatism
 - Lens Density
 - Prior Eye Surgery:
 - Retina Detachment Surgery
 - RK Surgery
 - PRK/LASIK



ORA®: Optiwave Refractive Analyzer

- Permits measurements to be taken in the OR after the lens is removed
- Permits measurements to be confirmed after the lens is implanted to guide correct power and position
- Permits real-time surgical adjustments

ORA®: Results

- Accuracy has eclipsed 90%
 - 94% of eyes are within 1D of target
- Need for refractive adjustments decreased by over 50%
- Accuracy in post-LASIK eyes is 19% better
- >80,000 ORA Guided Surgeries are now performed annually
- 2014: WaveTec was purchased by Alcon

"Intraoperative Refractive Biometry for Predicting Intraocular Lens Power Calculation after Prior Myopic Refractive Surgery," was authored by Tsoncho Ianchulev, MD, MPH; Kenneth J. Hoffer, MD, FACS; Sonia H. Yoo, MD; David F. Chang, MD; Michael Breen, OD; Thomas Padrick, PhD; and Dan B. Tran, MD.

Technique

Laser-Assisted Cataract Surgery



- Femtosecond Cataract Surgery
 - First used clinically in Budapest in 2008
 - First U.S. use was in Houston in 2010

Laser-Assisted Cataract Surgery

- Femtosecond Laser
 - Technology adapted from LASIK
- Creates tiny bubbles within tissue that can be connected to create an incisional plane

LenSx: Animation

<https://www.youtube.com/watch?v=nOHzPH1BV0>

<https://www.myalcon.com/products/surgical/lensx-laser/automation.shtml>

Laser-Assisted Cataract Surgery

- Ideal Candidates:
 - Patients motivated to achieve astigmatic correction at the time of cataract surgery
 - Patients without other ocular disease
 - corneal scarring/prior RK surgery
 - macular degeneration
 - Prior retinal artery or vein occlusion

Patients motivated to consider potential improvements in surgical safety and precision

Laser-Assisted Cataract Surgery

- Benefits:
 - Improved safety profile postulated
 - Less fluid to pass through the eye
 - Less collateral damage to tissue
 - More precise delivery of energy
 - Less inflammation can lead to quicker recovery
 - Permits blade-free surgery
 - Ability to alter corneal shape and treat some astigmatism at the same time as cataract surgery
- IMPROVED VISUAL OUTCOMES ARE POSSIBLE IN SOME PATIENTS

Laser Cataract Surgery: Results

- 30% Reduction of ultrasound time
- 40% Reduction in Cumulative Dissipated Energy (CDE)
- Reduction of intraoperative complications
 - De la Cruz Safety of Femtosecond Laser-Assisted Cataract Surgery Performed by Surgeons in Training. Joshua H. Hou, MD; Adam L. Prickett, MD; Maria S. Cortina, MD; Sandeep Jain, MD; Jose de la Cruz, MD. J Refr Surgery. Jan 2015. Voll 31 (1): 69-70.
- Reduction in inadvertent capsular tears & need to suture the wound

Int J Ophthalmol. 2015 Feb 18;8(1):201-3. doi: 10.3980/j.issn.2222-3959.2015.01.34. eCollection 2015.
Comparing the intraoperative complication rate of femtosecond laser-assisted cataract surgery to traditional phacoemulsification.
Chen M1, Swinney C1, Chen M2

“Premium” Lenses

- What if the physician could address all 3 visual problems (cataract, refractive error, & presbyopia) all at the same time?

Multifocal IOL: fixed lens with multiple focal distances to provide near vision AND distance vision in attempting to reduce spectacle dependence

Pseudo-Accommodative IOL: lens that *moves* to provide MIDRANGE vision AND distance vision in attempting to reduce spectacle dependence

Toric IOL: lens that neutralizes astigmatism and distance *or* near vision

Pseudo-Accommodative: lens that neutralizes astigmatism and

Toric IOL: distance *and* near vision in attempting to reduce spectacle independence

Premium IOL' s

- Alcon ReStor® AMO Tecnis Multifocal® B&L Crystalens/Trulign® AMO Symphony®
 - Alcon ReStor® remains the most commonly implanted premium IOL
 - Tecnis Multifocal® is the newest of these multifocals
 - New low-add Tecnis now available
 - B&L Crystalens® available in a toric version (Trulign®)
 - AMO Symphony® is newest premium IOL to gain FDA approval (2016)

Alcon ReStor®

- 9 “Apodized” Refractive rings that create 2 focal distances, so near and far are imaged simultaneously
- Center of the lens is distance vision
- As pupil dilates, you increase near add
- Acts very similarly to a progressive eyeglass lens
- Pros: Quicker recovery than Crystalens™
Better near vision than Crystalens™
- **SUMMARY:** A- Distance, B- Midrange, B+ Near

AMO Tecnis® Multifocal

Similar to ReStor® but not yellow and with more substantial add for near

- Full Optic Diffractive balanced for near & far
- Quality near image even in low light (better than ReStor)

SUMMARY: A- Distance, B Midrange, A Near

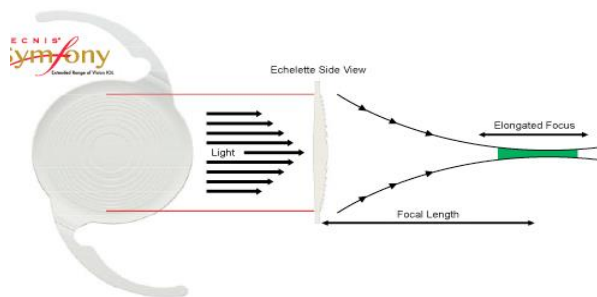
- May be better in low light & at near than ReStor®
- May be better at near than Crystalens®
- Haloes can be troubling in some patients

Fine I, et al. Refractive Lens Surgery. 2005. Pgs. 137-150

B&L Crystalens AO®

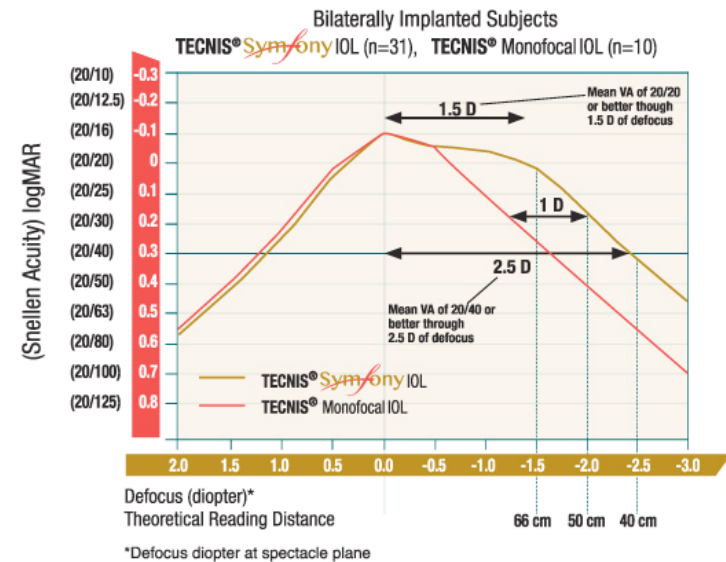
- Optic with hinged haptic allows lens to move
- Translational “accommodative” mechanism
 - Ciliary muscle contraction
 - Forward movement of lens for near vision
- Has some image degradation across central 1-2 mm
- “AO” version denotes aspheric optic (January 2010)
- Main advantage: no rings across optic provides less risk of haloes
- **SUMMARY:** A Distance, A-/B+ Midrange, C+ Near

AMO Symfony®



- Diffractive IOL that elongates the focus of the lens to create an extended range of vision
- Goal is to provide a continuous range of distance, mid, and near vision
- By using elongation of focus rather than multiple focal points, haloes are suppressed
- Modifies height and profile of the diffractive echelette to elongate the focus

Defocus Curve: 3-Month Adjusted Data



From AMO promotional materials

New Lenses on the Horizon

- Trifocal IOL's
 - Multiple companies have developed and lenses are being used in Europe
 - PhysiOL FINEVision™
 - Zeiss ATLISA tri 839MP™
 - Alcon AcrySof IQ PanOptix™

Trifocal IOL's

- PhysiOL: FINEVision (Belgium)
 - F(ar) I(ntermediate) NE(ar) trifocal
 - First trifocal diffractive IOL (2010)
 - Apodized optic
 - 42% distance
 - 15% intermediate
 - 29% near
 - 25% hydrophilic acrylic aspheric IOL
 - +1.75 intermediate
 - +3.50 near
 - Available +10.0D through +35.0D
 - Requires >1.8 mm incision
 - First trifocal diffractive toric IOL (2014)

Trifocal IOL's

- Zeiss: ATLISA tri 839MP (2012)
- Single piece hydrophilic acrylic with hydrophobic surface
 - +1.66 intermediate
 - +3.33 near
- Design
 - 50% distance
 - 20% intermediate
 - 30% near

Trifocal IOL's

- Alcon: CE Mark for AcrySof IQ PanOptix trifocal IOL (6/15)
- US studies started February 2016

Trifocal IOL's

- Marques: (Portugal)
 - Prospective comparative case series of 198 eyes of 99 patients
 - Monocular distance better with FINE than Zeiss
 - Overall excellent results with distance, mid, and near vision

Eduardo F. Marques, MD, Tiago B. Ferreira, MD. Comparison of visual outcomes of two diffractive trifocal intraocular lenses. *Journal of Cataract Refractive Surgery* 2015; 41:354–363

- Cochener: (France)
 - 31% of patients symptomatic for glare
 - 40% reported ghosting of images
 - 49% report haloes
 - 80% report problems driving at night

Cochener B, Vryghem J, Rozot P, et al. *Clinical Outcomes With a Trifocal Intraocular Lens: A Multicenter Study. Journal of Refractive Surgery.* 2014;30: 762-768.

Calhoun Vision Light-Adjustable IOL™

- IOL that is adjustable after implantation based on patient experience
- Silicone optic can be adjusted with UV light to alter its power
- Surgeon can add asphericity to the optic to broaden range of vision to blend
- Currently in FDA trials

Cataract Surgical Planning

- This is CONFUSING!
 - Lots of choices = lots of decisions
 - Patient Education is Critical
- Our Cataract Patient Protocol:
 - 1.) Consultation with Surgeon
 - 2.) Biometry Meeting & Counseling
 - 3.) Surgery

Cataracts: Things To Tell Your Doctor If You Are Considering Surgery

- Notify your doctor if you are on any blood-thinning agents, such as Coumadin, Plavix, Aspirin, or Ibuprofen
- Notify your doctor if you are on Flomax or *any* prostate medications
- Notify your doctor if you suffer from claustrophobia, anxiety, or cannot lie flat for any period of time
- Notify your doctor of any medication allergies or if you have had adverse reactions to any anesthesia in the past

Thank You



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