

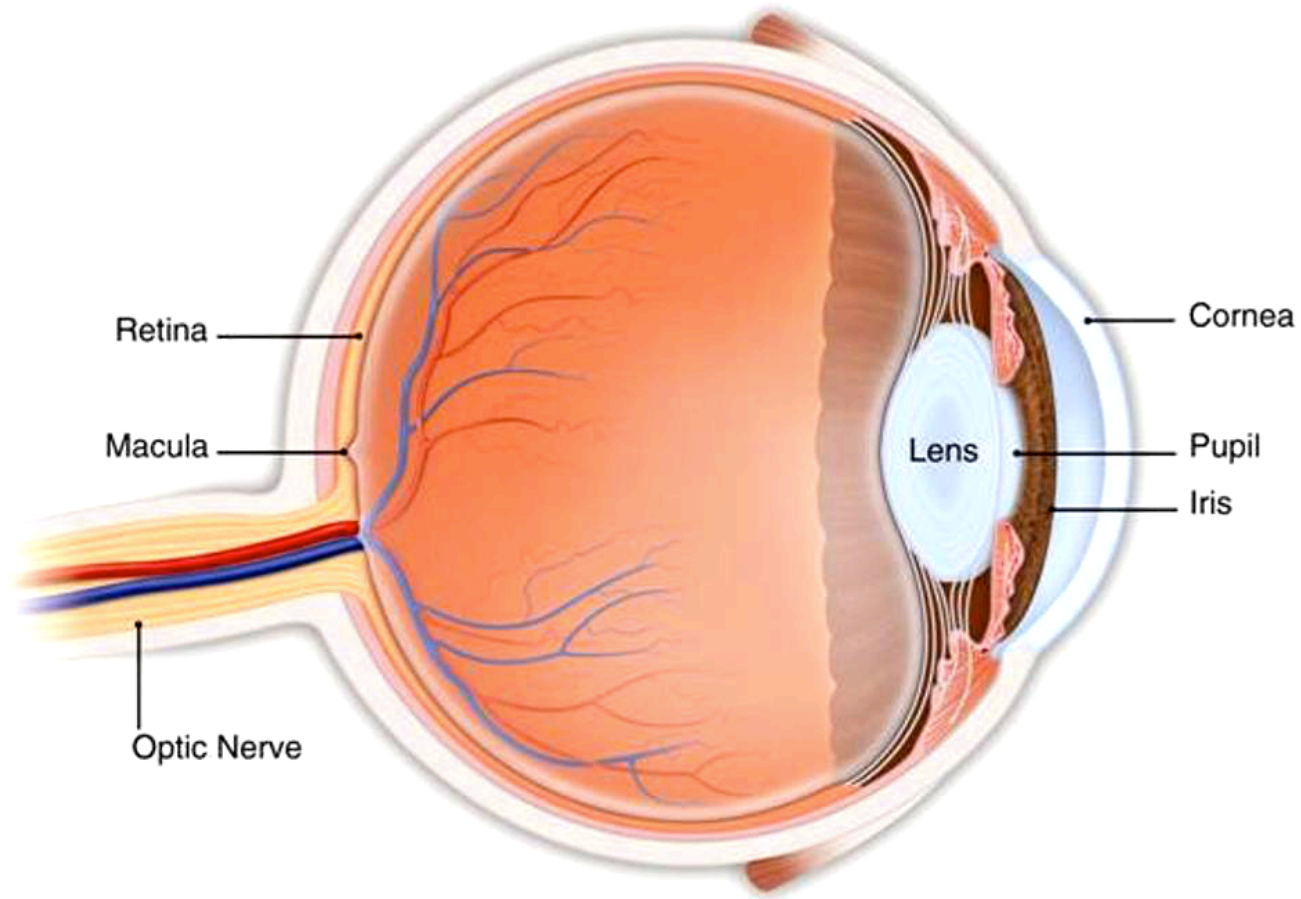
REFRACTIVE ERROR AND SURGERIES IN THE UNITED STATES

- 150 million wear eyeglasses or contact lenses
- 2.3 million refractive surgeries performed between 1995 and 2001

REFRACTIVE SURGERY: POPULARITY, EFFICACY, SAFETY

- LASIK (laser in-situ keratomileusis) currently most performed procedure
- LASIK improves vision to 20/20 in up to 93.5% of patients with low to moderate nearsightedness
- Long-term outcomes of refractive surgery as yet unavailable

Primary care physicians' understanding of refractive procedures helps ensure quality patient care.



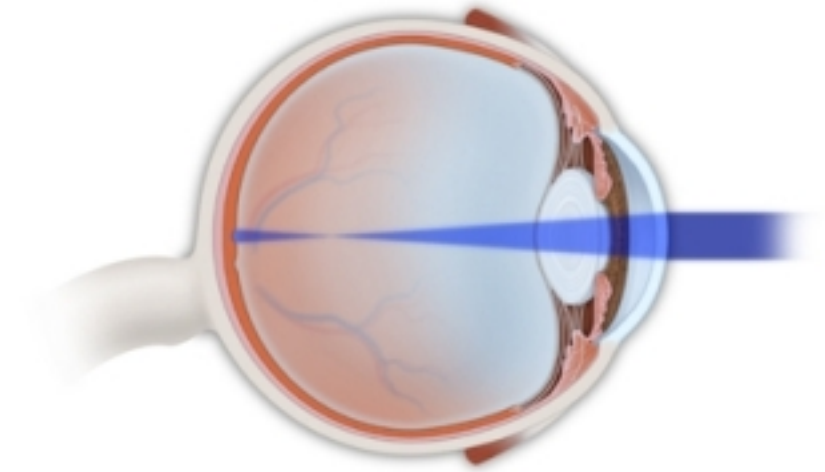
The human eye

REFRACTIVE ERRORS

- Myopia—nearsightedness
- Hyperopia – farsightedness
- Astigmatism—irregularly shaped cornea, causing blurred vision
- Presbyopia—age-related loss of lens flexibility, causing reduced near vision

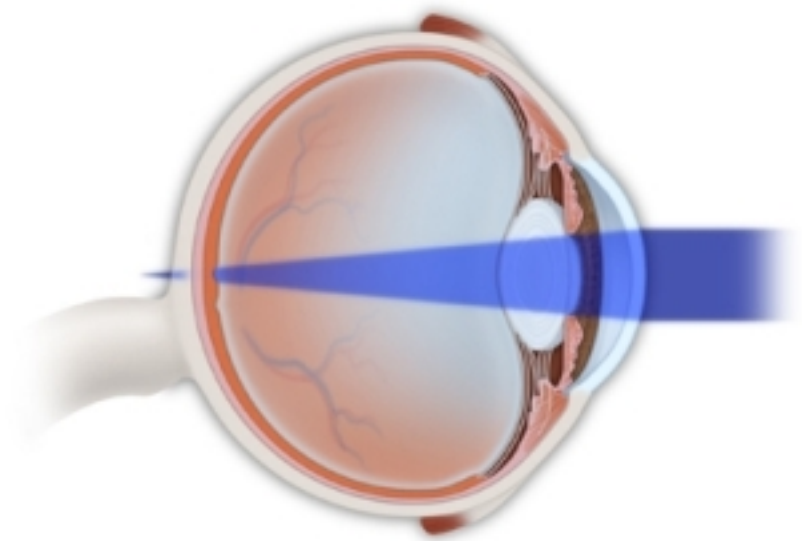
MYOPIA (NEARSIGHTEDNESS)

- Images focus in front of retina
- Severity is related to success of refractive surgery



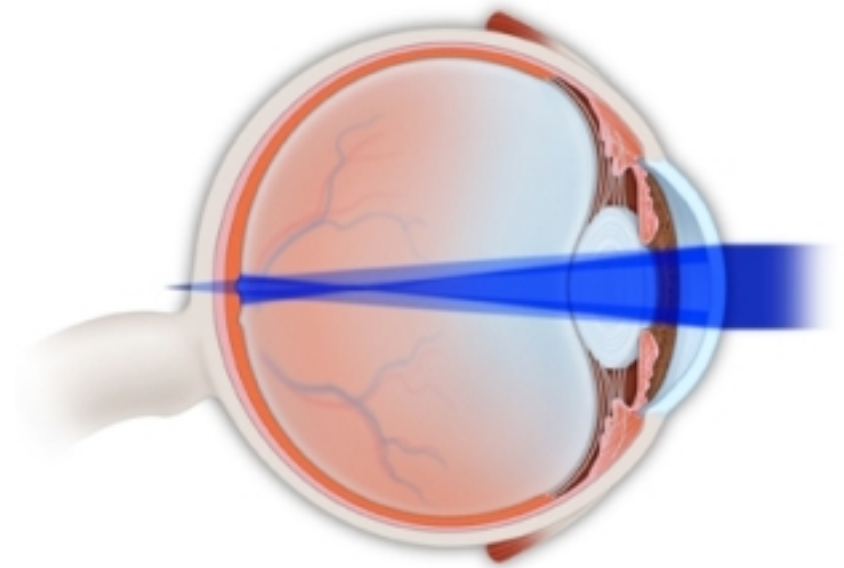
HYPEROPIA (FARSIGHTEDNESS)

- Images focus behind the retina
- Renders refractive surgery less predictable, requires longer to stabilize



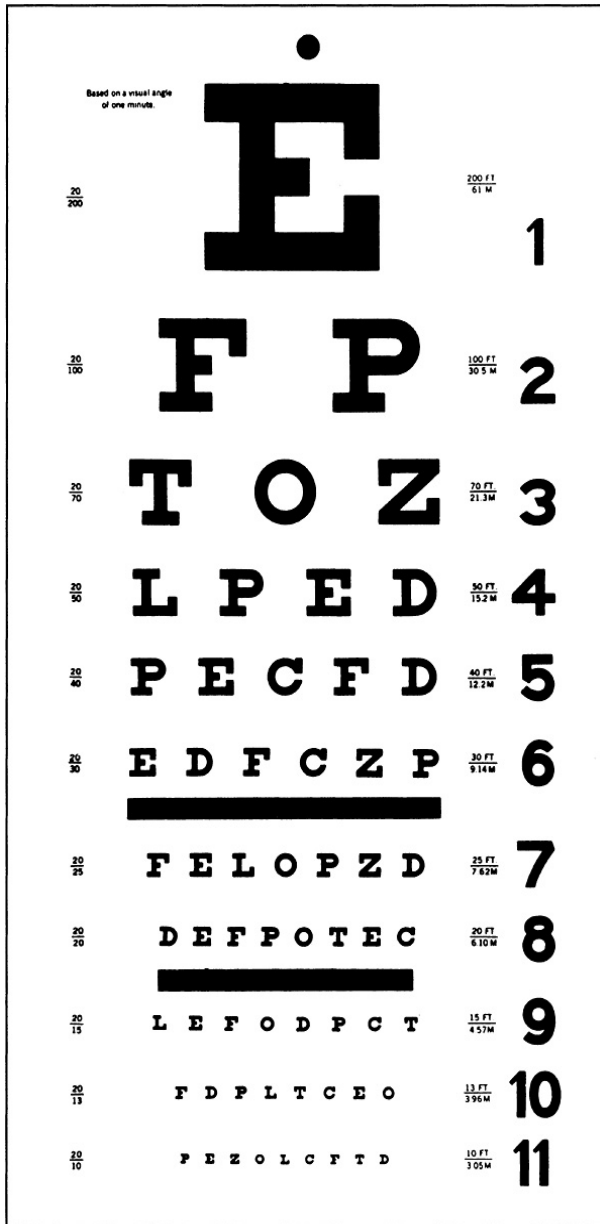
ASTIGMATISM (BLURRED VISION)

- Uneven curvature of cornea
- Causes separate areas of focus and consequent blurring



PRESBYOPIA (LOSS OF FOCUSING ABILITY)

- Loss of accommodation with age
- Manifests in early 40s
- Cannot be halted or mitigated with refractive surgery



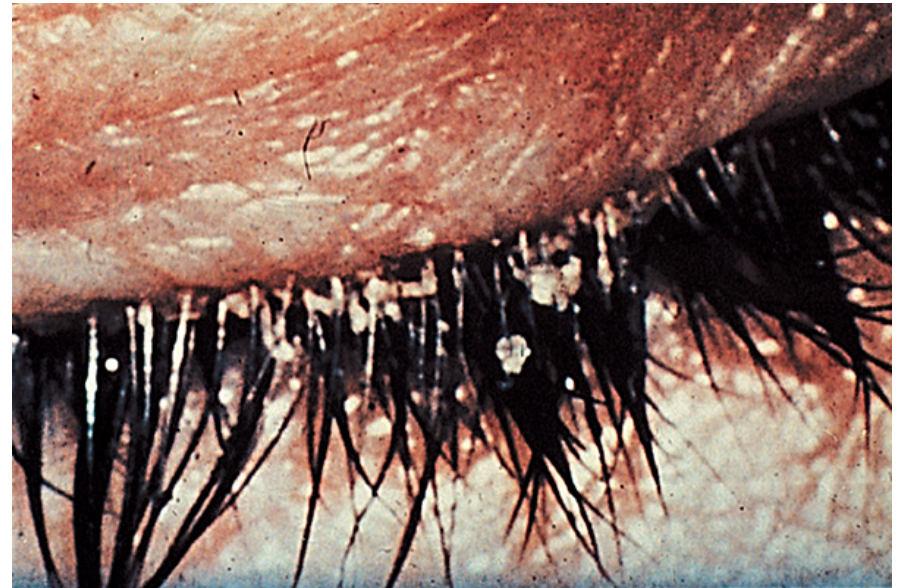
Snellen visual acuity chart

SCREENING CANDIDATES FOR REFRACTIVE SURGERY

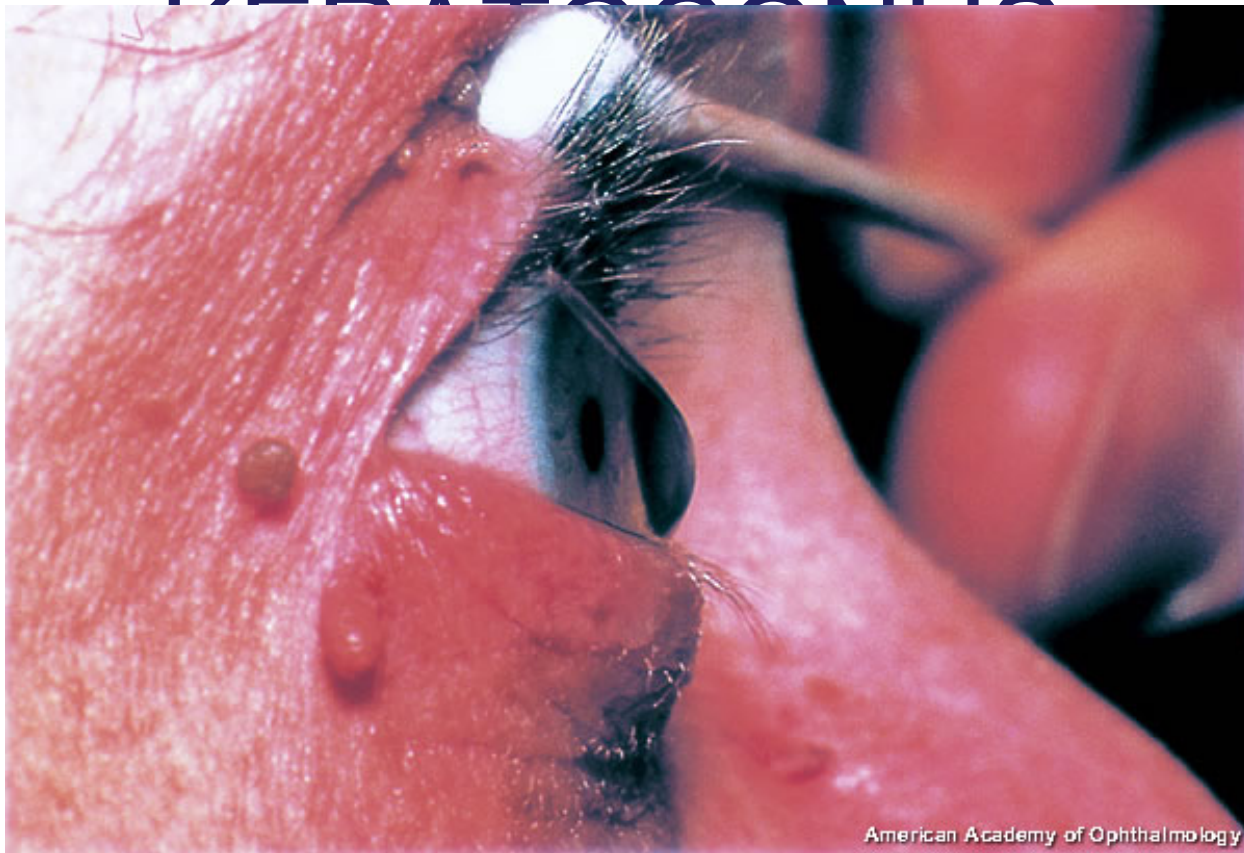
- Success relies on sound total eye health
- Ameliorate correctable ocular disorders prior to surgery

DISORDERS OF TEAR FILM AFFECTING REFRACTION

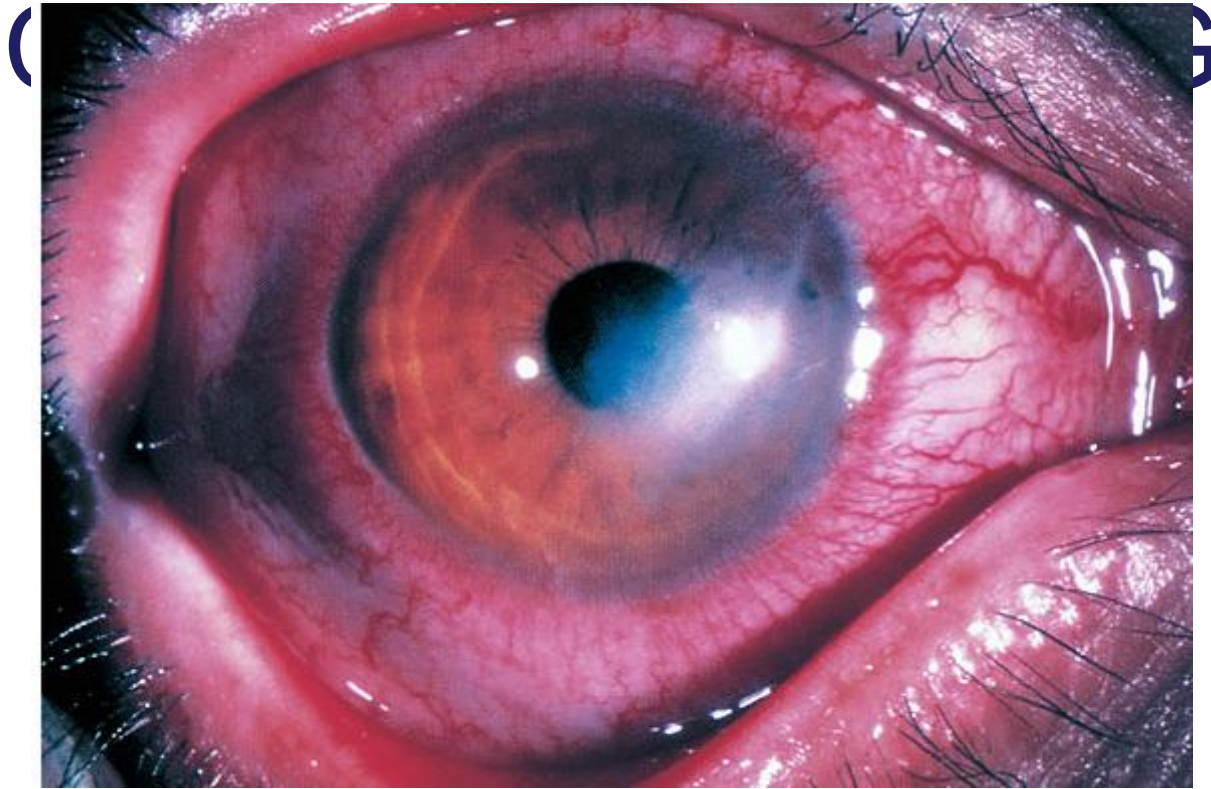
- Dry eye
 - Watery or dry eyes, visual fluctuation
- Blepharitis (shown)
 - Burning, watering



CORNEAL DISORDERS AFFECTING ACUITY:



CORNEAL DISORDERS AFFECTING ACUITY:

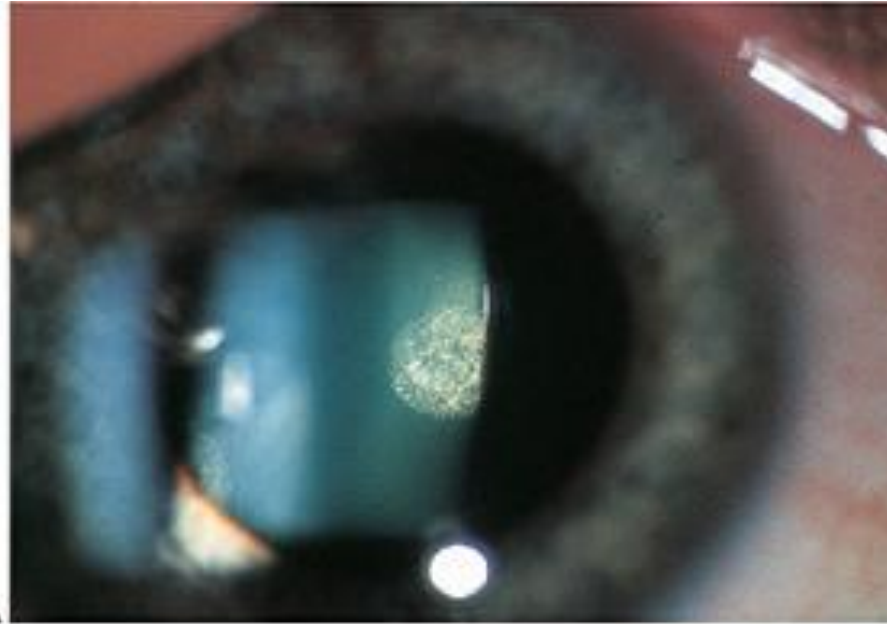


IRIS AND PUPIL CONDITIONS AFFECTING ACUITY

- Iris defects may cause blurring or multiple images
- Large pupils may lead to the appearance of postsurgical glare (top) or halos (bottom)



LENS DISORDERS AFFECTING ACUITY



Cataract seen through pupil as a white opacity

RETINAL DISORDERS AFFECTING ACUITY

- Diabetic retinopathy
- Retinal detachment
- Cystoid macular edema
- Retinal scar
- Age-related macular degeneration

CNS DISORDERS AFFECTING ACUITY

- Amblyopia
- Disorders of visual cortex
- Ischemia

PATIENT EVALUATION FOR REFRACTIVE PROCEDURE

- Comprehensive process requiring excellent doctor-patient communication
 - Preoperative interview
 - Examination
 - Ancillary testing

PREOPERATIVE EXAMINATION: PATIENT EXPECTATIONS

- Possibly most important predictor of surgical “success”
- Patients demanding “perfect vision” not good candidates

PREOPERATIVE EXAMINATION: SOCIAL HISTORY

- Visual needs of work or play: Needs of a teacher versus a young baseball player versus a middle-aged golfer/accountant

PREOPERATIVE EXAMINATION: MEDICAL HISTORY

- Systemic diseases may compromise success
 - Diabetes
 - Collagen vascular (rheumatoid arthritis, lupus, Sjögren' s)
 - Immunosuppression
 - Pregnancy/nursing contraindicate procedure

PREOPERATIVE EXAMINATION: MEDICINES

- **Contraindicated for LASIK**
 - Accutane
 - Imitrex
 - Amiodarone
- **Other medicines with possible effects**
 - Antihistamines
 - ± Anticoagulants?

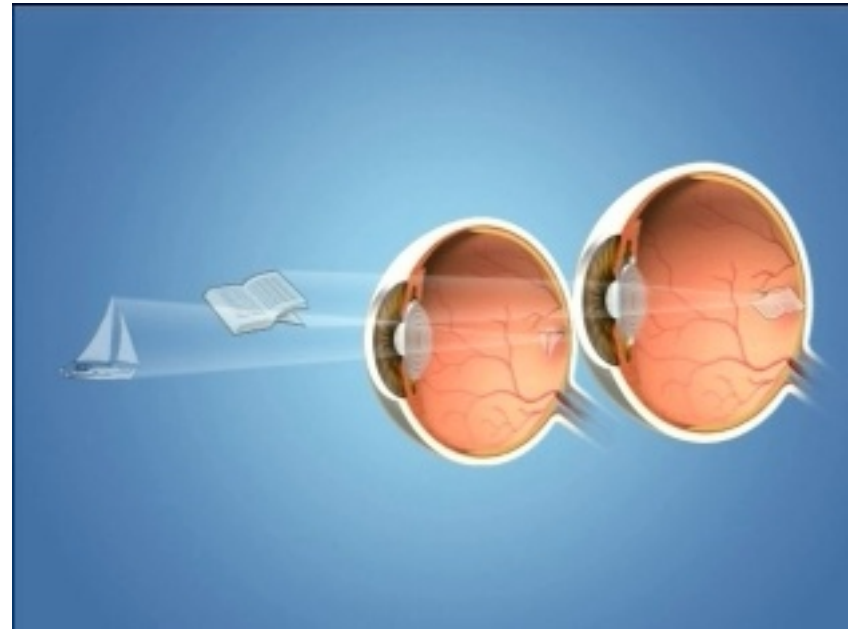
PREOPERATIVE EXAMINATION: OCULAR HISTORY

- Contact lens wear
- Trauma
- Previous surgery
- Glaucoma
- Ocular HSV
- Family history

PREOPERATIVE EXAMINATION: MONOVISION

- Tolerated by 85% of population with up to several weeks' adjustment period
- Contact lens trial before procedure
- Can be used in a variety of refractive procedures
- One eye (dominant) set for distance and one eye set for near or intermediate (as shown)

POSSIBLE?

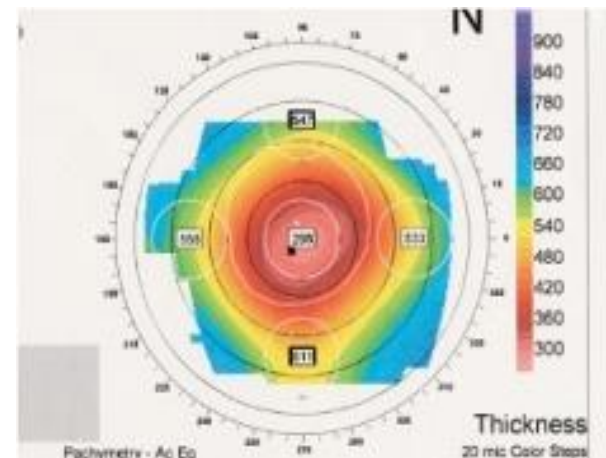
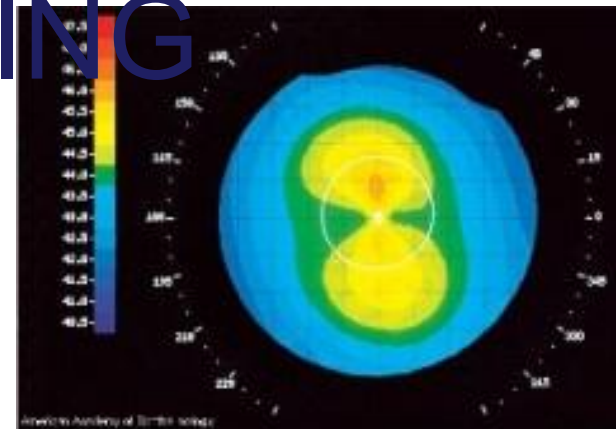


PREOPERATIVE EXAMINATION: OCULAR EXAMINATION

- Visual acuity
- Pupil exam
- Ocular motility
- Confrontation visual fields
- Intraocular pressure
- Slit-lamp exam
- Dilated fundus exam

PREOPERATIVE EXAMINATION: ANCILLARY TESTING

- Corneal topography
(as shown on top)
- Pachymetry
(as shown on bottom)
- Wavefront analysis
- Ultrasound/interferometry to measure axial length

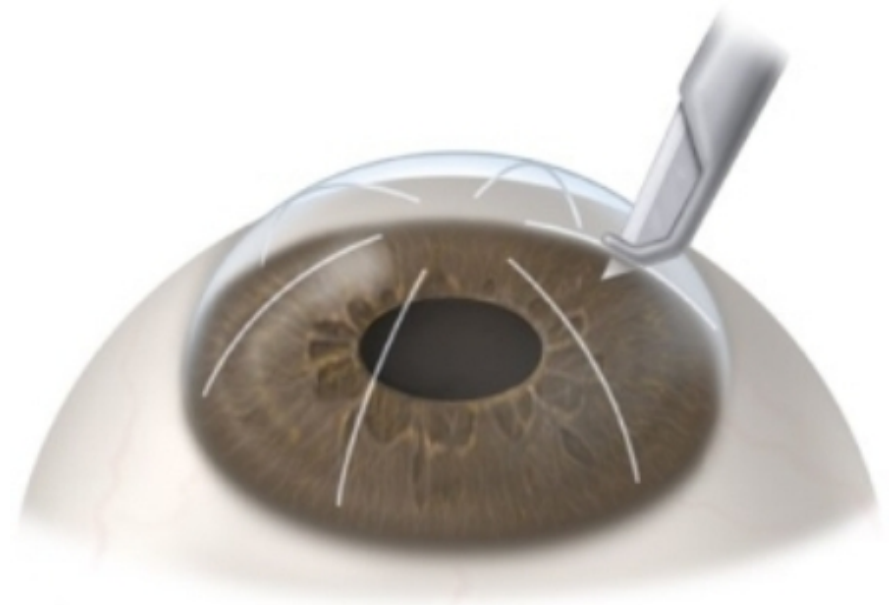


PROCEDURES IN REFRACTIVE SURGERY

- Incisional corneal surgery
 - RK, AK
- Corneal inserts
 - Intacs
- Photoablative procedures
 - LASIK, LASEK, PRK
- Conductive keratoplasty
- Intraocular surgery
 - Phakic IOLs
 - Natural lens replacement

RADIAL KERATOTOMY (RK)

- Developed in the 1970s
- Multiple radial cuts into corneal stroma to correct mild to moderate myopia
- No longer the most popular, safest, or most stable refractive procedure

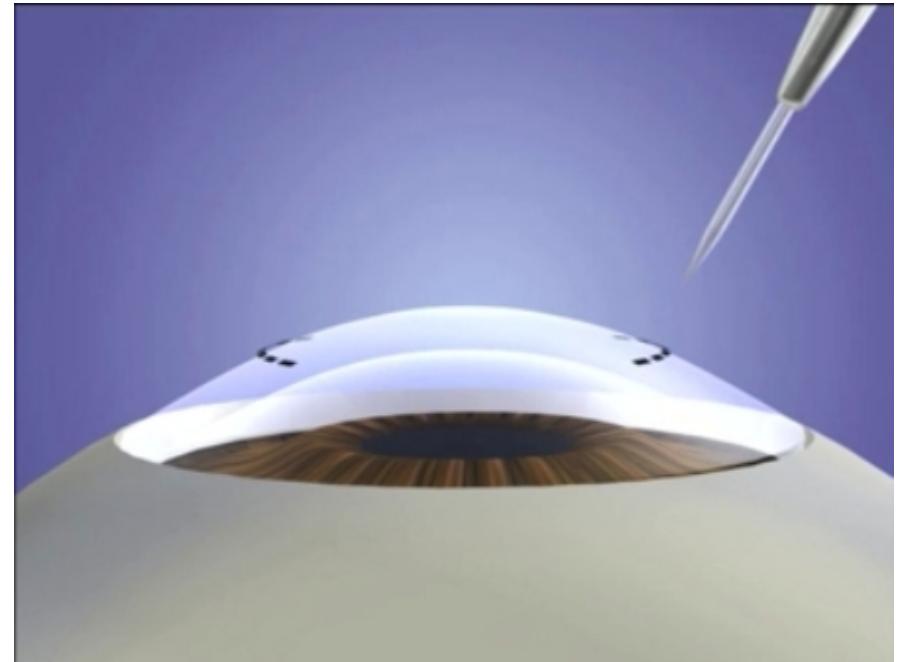


RADIAL KERATOTOMY (RK): COMPLICATIONS

- Lack of stability—refractive fluctuations and shifts
- Complications
 - Irregular astigmatism
 - Glare
 - Wound dehiscence

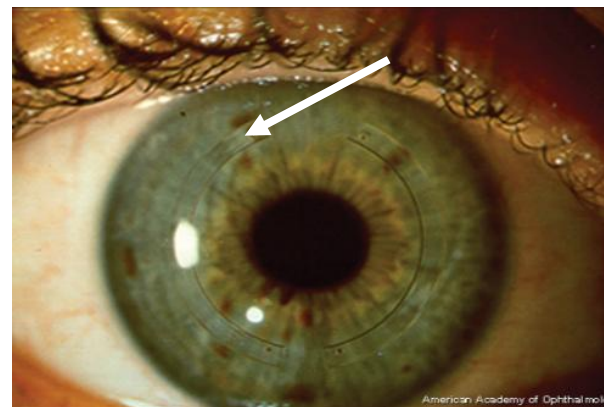
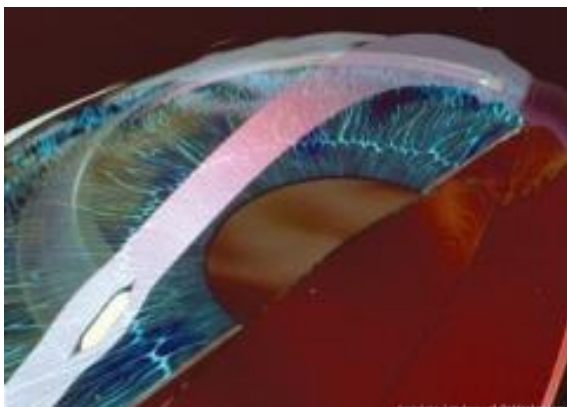
ARCUATE KERATOTOMY (AK)

- Tangential incisions in cornea used to correct astigmatism
- Same risks as RK
- Often used in conjunction with cataract surgery



INTRASTROMAL CORNEAL RINGS (INTACS)

- Circular rings of polymethylmethacrylate (PMMA) placed in mid peripheral stroma
- Treats low myopia
- Removable/exchangeable



Cross section of cornea with INTACS Vertical placement of INTACS

PHOTOABLATIVE PROCEDURES

- Excimer (“excited dimer”) laser
 - Allows precise removal of corneal tissue
 - Pattern can be “customized”
- Used for PRK, LASEK, LASIK



PHOTOREFRACTIVE KERATECTOMY (PRK): PROCEDURE

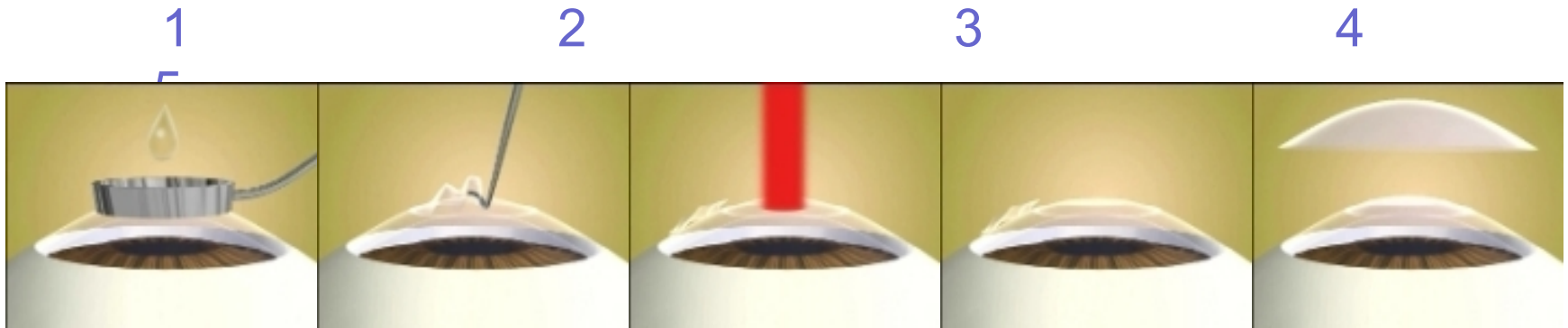
- Alcohol placed to loosen epithelium
- Central epithelium debrided
- Laser ablation
- Epithelium grows back from periphery under bandage contact lens

PRK: ADVANTAGES AND DISADVANTAGES

- **Advantages**
 - No corneal flap complications
 - Long-term stability
 - Can perform on thin cornea
- **Disadvantages**
 - More patient discomfort
 - Inconvenience: usually done one eye at a time
 - Slightly higher risk of infection
 - Risk of haze (mitomycin C may minimize)
 - Glare/halos

LASER SUBEPITHELIAL KERATOMILEUSIS (LASEK): PROCEDURE

1. Alcohol used to loosen epithelium
2. Epithelium carefully rolled back
3. Laser ablation of underlying surface
4. Tissue removed by laser
5. Epithelium replaced and protected with bandage contact lens



LASEK: ADVANTAGES AND DISADVANTAGES

- **Advantages**
 - Same as PRK
 - Epithelial flap replacement helps with post-op pain
- **Disadvantages**
 - Inconvenient: usually performed one eye at a time
 - Same risks as PRK
 - Glare/halos

LASER IN SITU KERATOMILEUSIS

- ## (LASIK) PROCEDURE
1. Suction ring stabilizes globe
 2. Microkeratome creates thin stromal flap with a hinge
 3. Flap reflected back
 4. Laser ablation sculpts cornea
 5. Stromal flap replaced



LASIK: ADVANTAGES AND DISADVANTAGES

- **Advantages**
 - Little discomfort
 - Fast visual recovery
 - Long-term stability
- **Disadvantages**
 - Thin corneas not good candidates
 - Flap complications
 - Glare/halos
 - Diffuse lamellar keratitis (DLK)

LASER DIFFERENCES

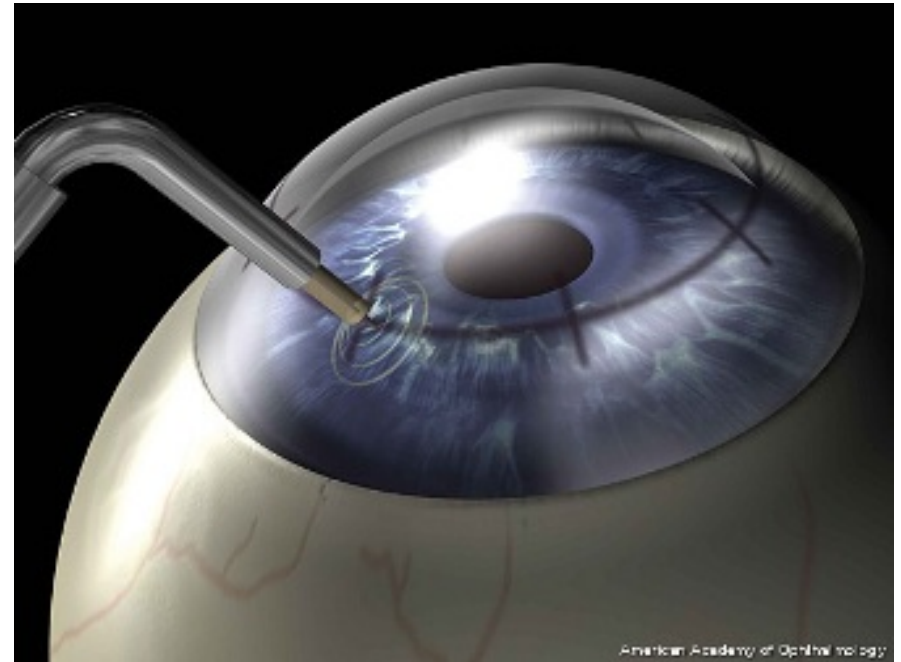
- **Conventional laser**
 - Laser program “imprints” standard refraction onto cornea
- **Wavefront-guided or “custom” laser**
 - “Imprints” patient’s custom refraction
 - Theoretically removes aberrations in cornea
 - Higher chance of reaching refractive goal in low/moderate myopes
- **Either can be used for PRK/LASEK/LASIK**

LASIK: OTHER ISSUES

- **Enhancement**
 - LASIK flaps can be lifted for later retreatment/refinement of refraction
- **Monovision**
 - Dominant eye set for distance
 - Other eye for intermediate or near
 - Careful explanation of visual outcome necessary for patient satisfaction

CONDUCTIVE KERATOPLASTY

- Fine conducting needle delivers radiofrequency energy into peripheral cornea
- Locally shrinks collagen fibers
- Corrects low hyperopia/astigmatism
- Induces myopia to give presbyopes greater focus at near



CONDUCTIVE KERATOPLASTY: ADVANTAGES AND DISADVANTAGES

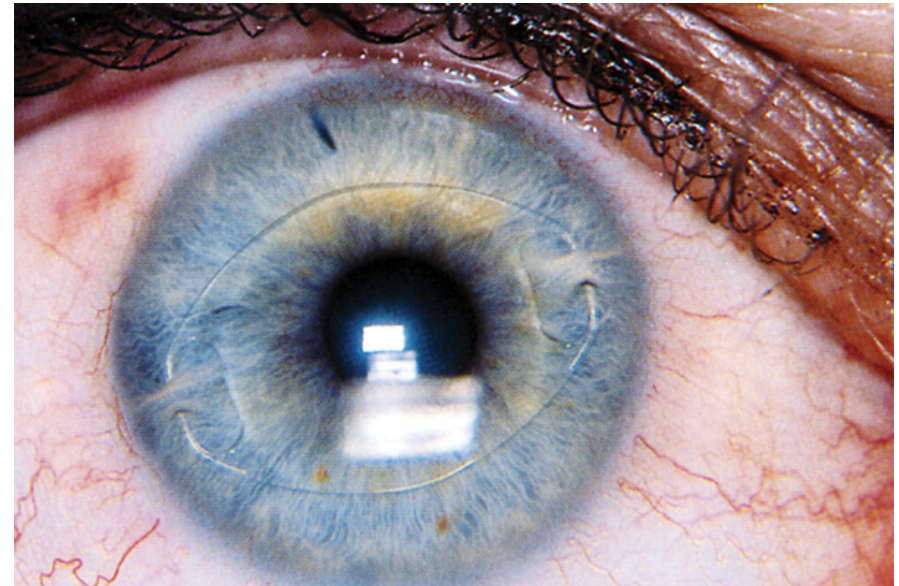
- **Advantage**
 - Relatively safe, quick, and noninvasive
- **Disadvantage**
 - No long-term data demonstrating stability

INTRAOCULAR SURGERY

- Improved technology and techniques allow for relatively safe “elective” intraocular surgery
 - Phakic IOL
 - Clear lens extraction
 - Accommodative IOL

PHAKIC INTRAOCULAR LENSES (IOLs)

- IOL inserted into eye with natural lens still in place
- Allows for accommodation
- Typically used in younger high myopes
- Avoids ablation of cornea
- Removable
- Small risk of cataract and iritis



Phakic IOL in place

NATURAL LENS REPLACEMENT

- Replacing noncataractous crystalline lens with IOL for refractive purpose
- Indications
 - Not a good photoablative candidate
 - Cornea too thin, too flat, too steep
 - High myopia/hyperopia

NATURAL LENS REPLACEMENT: ADVANTAGES AND DISADVANTAGES

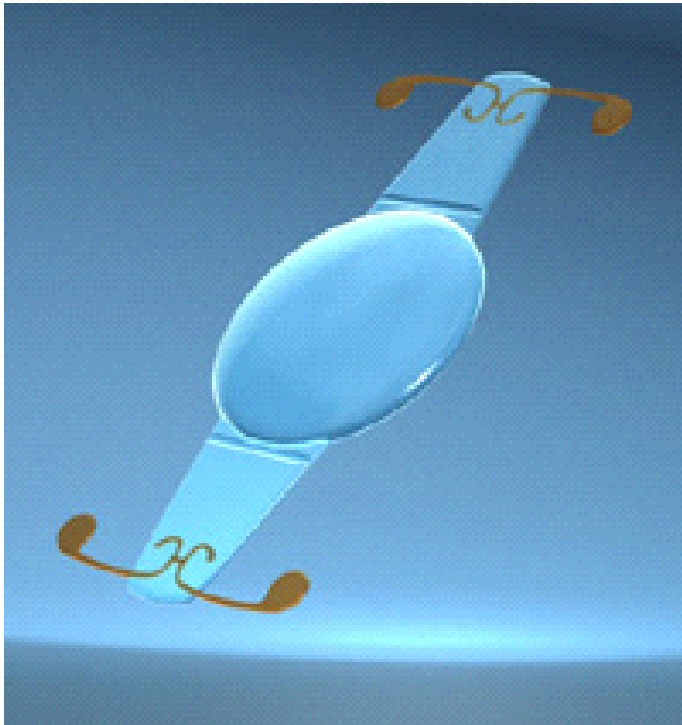
- Advantages

- Same procedure as cataract surgery
- Avoids risks of flap creation and corneal ablation
- Corrects high degree of myopia/hyperopia

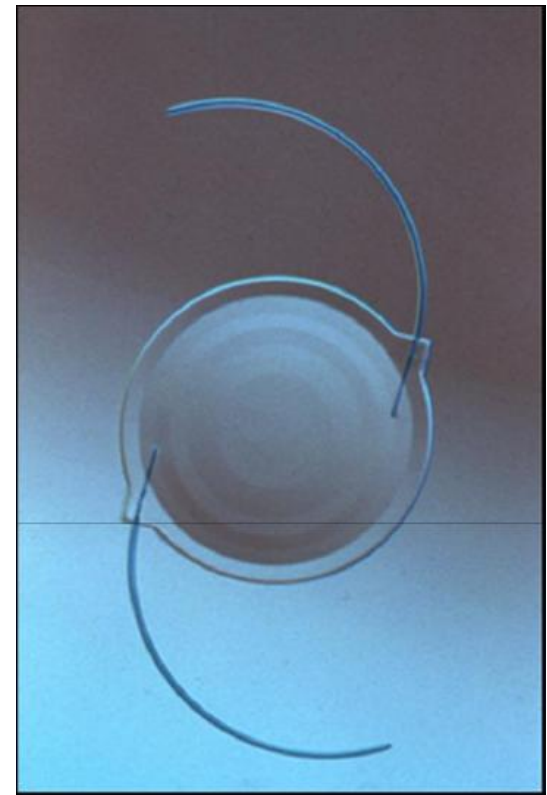
- Disadvantages

- Risk of intraocular surgery
 - Endophthalmitis, hemorrhage, retinal detachment
- Patient expectations

IOLs USED IN REFRACTIVE PROCEDURES



Accommodative IOL



Multifocal IOL

REFRACTIVE SURGERY: THE FUTURE

- Ongoing improvement in current lasers and techniques
- Customizable intraocular lenses
 - Programmable in-situ with certain wavelengths of light
 - Smaller incisions and instruments improving safety profile
- Knowledgeable PCPs can help counsel and advise patients considering refractive procedures