Air Force Corneal Refractive Surgery Informational Briefing

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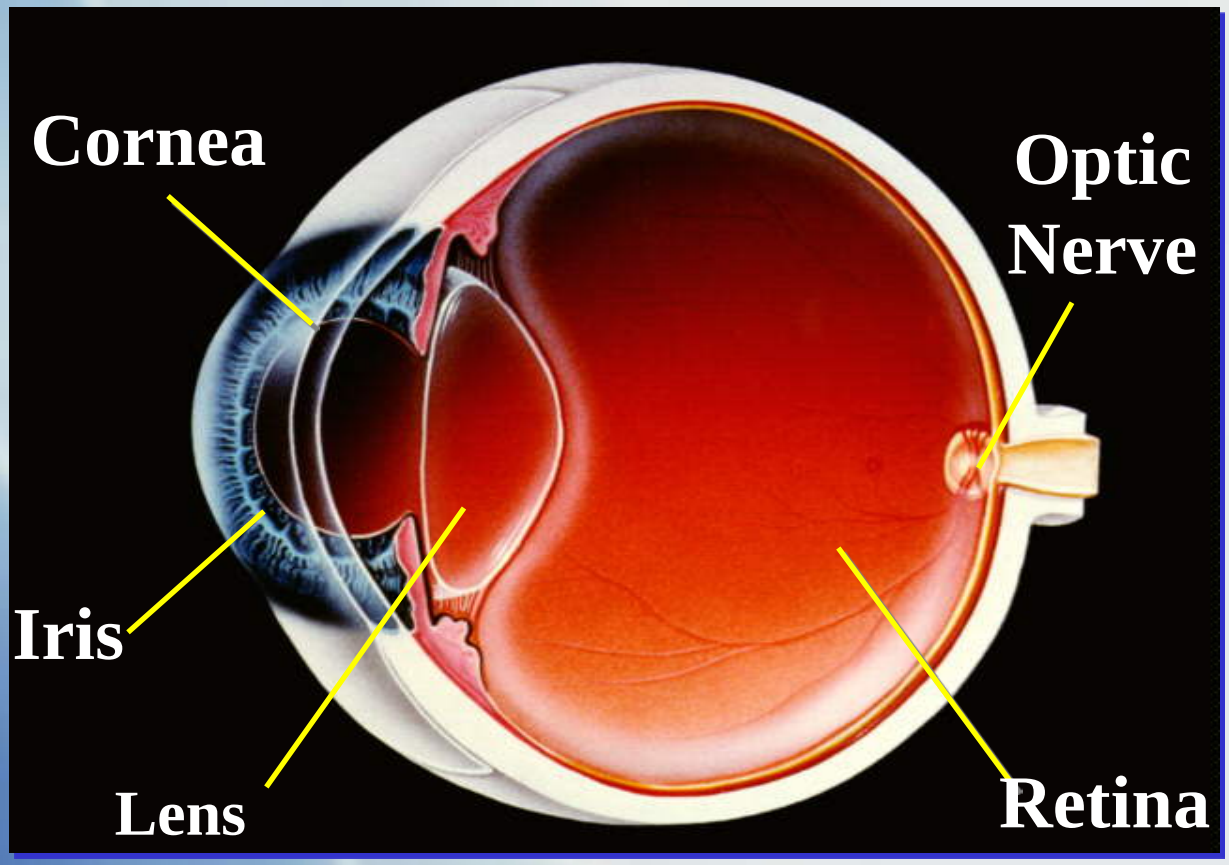
Overview

- Basic Eye Anatomy
- Types of Refractive Error
- Treatment of Refractive Error
- Description of PRK and Lasik
- Risks/Benefits of Treatment
- How to Apply for Surgery

Important Facts

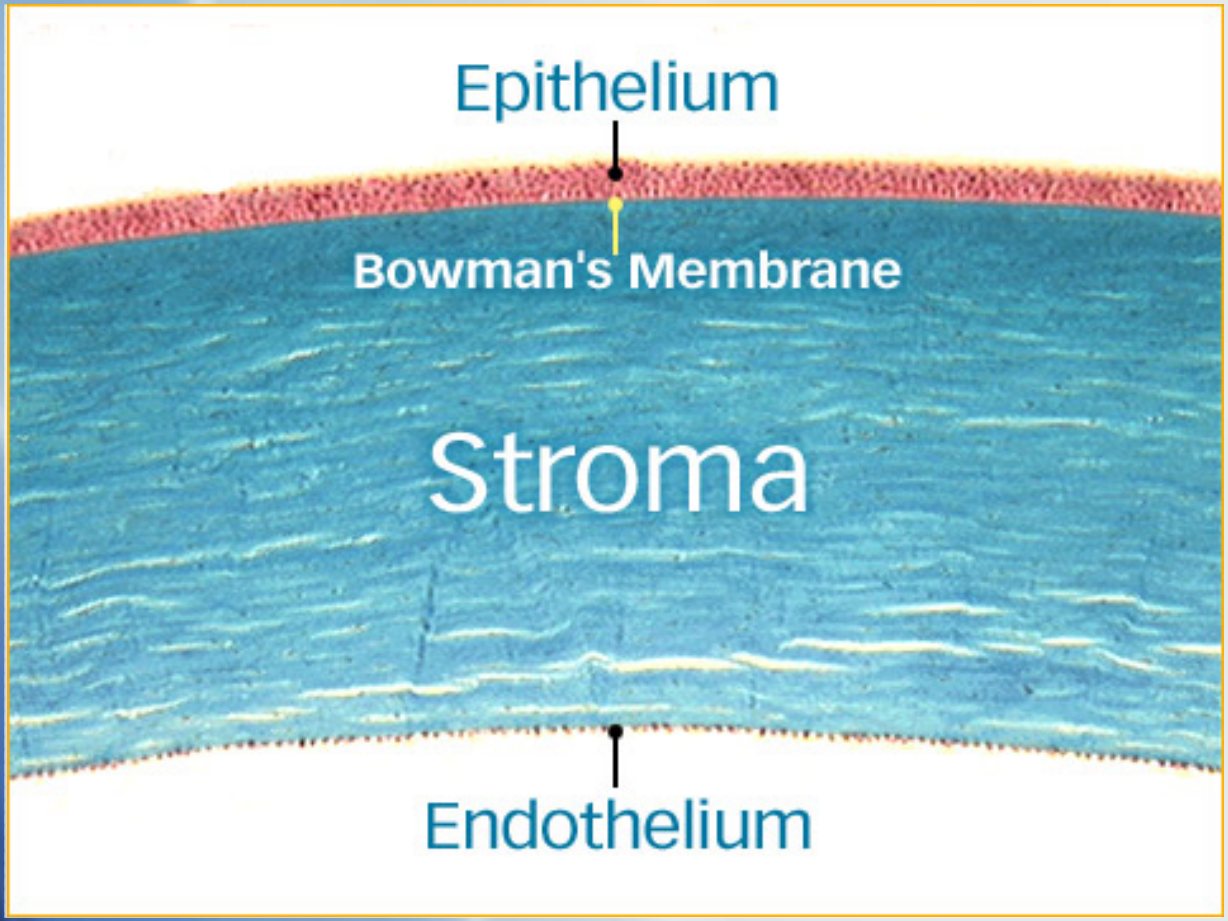
- Air Force Refractive Surgery is to <u>enhance readiness</u> by reducing dependence on spectacles and contact lens
- This is an elective procedure for active duty only
- No guarantee of spectacle independence

Anatomy of the Eye



The cornea is a clear “cap” on the surface of the eye. Behind it is the colored iris. Behind the iris, is the lens of the eye. The cornea and the lens focus light entering the eye. In a normal refractive state, the light rays are focused to a point that reaches the retina. The retina is like the film of a camera. It changes the light signal into electrical impulses which get sent to the brain

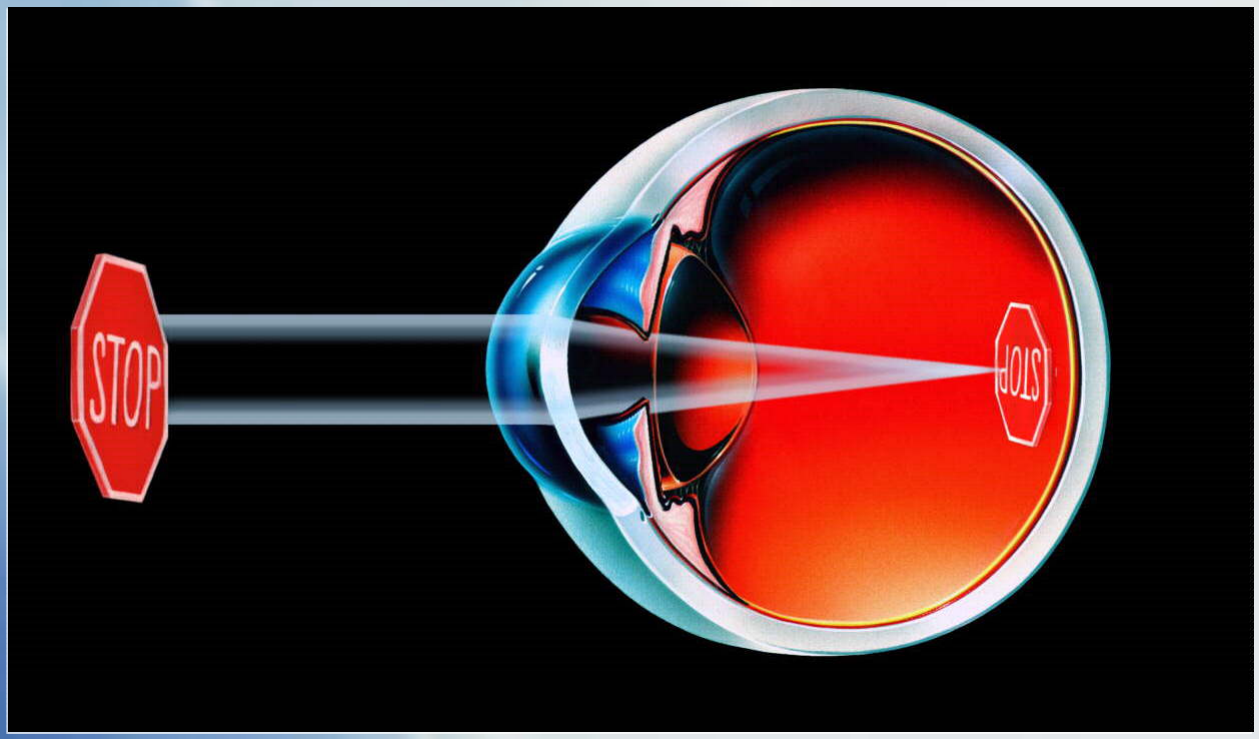
The Cornea



The cornea is the structure in the eye which gets shaped with the laser in "corneal refractive surgery." The cornea has three layers. A top "epithelial layer," a middle "stromal" layer, and a thin "endothelial" layer. The laser treatment in both PRK and LASIK are performed on the middle, stromal layer. How we get to the middle layer is the big difference between PRK and LASIK.

REFRACTIVE ERROR

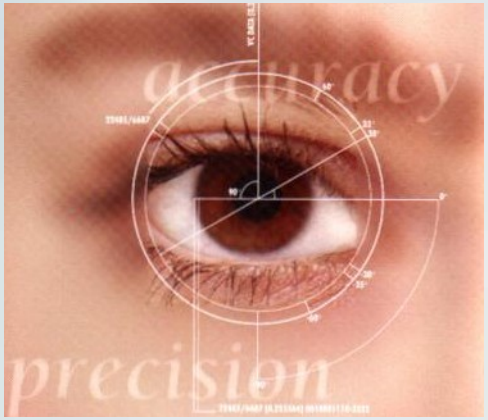
Normal Eye and Refraction



In a normal refractive state, the light rays from an image at distance are bent by the cornea and the lens so that a sharp image hits the retina

Refractive Error

- Myopia
- Hyperopia
- Astigmatism

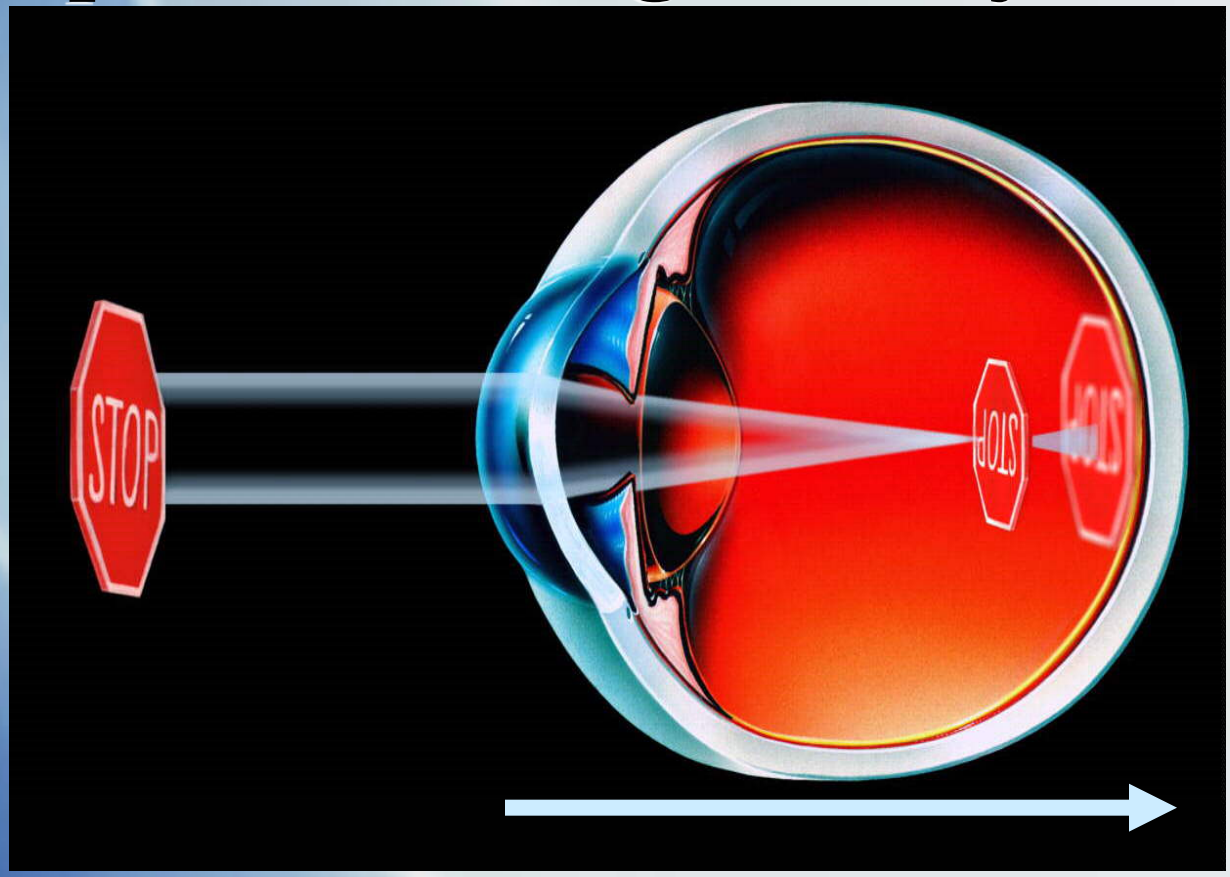


- Presbyopia*

Anything other than a normal refractive state is called refractive error.
The three types of refractive error are:

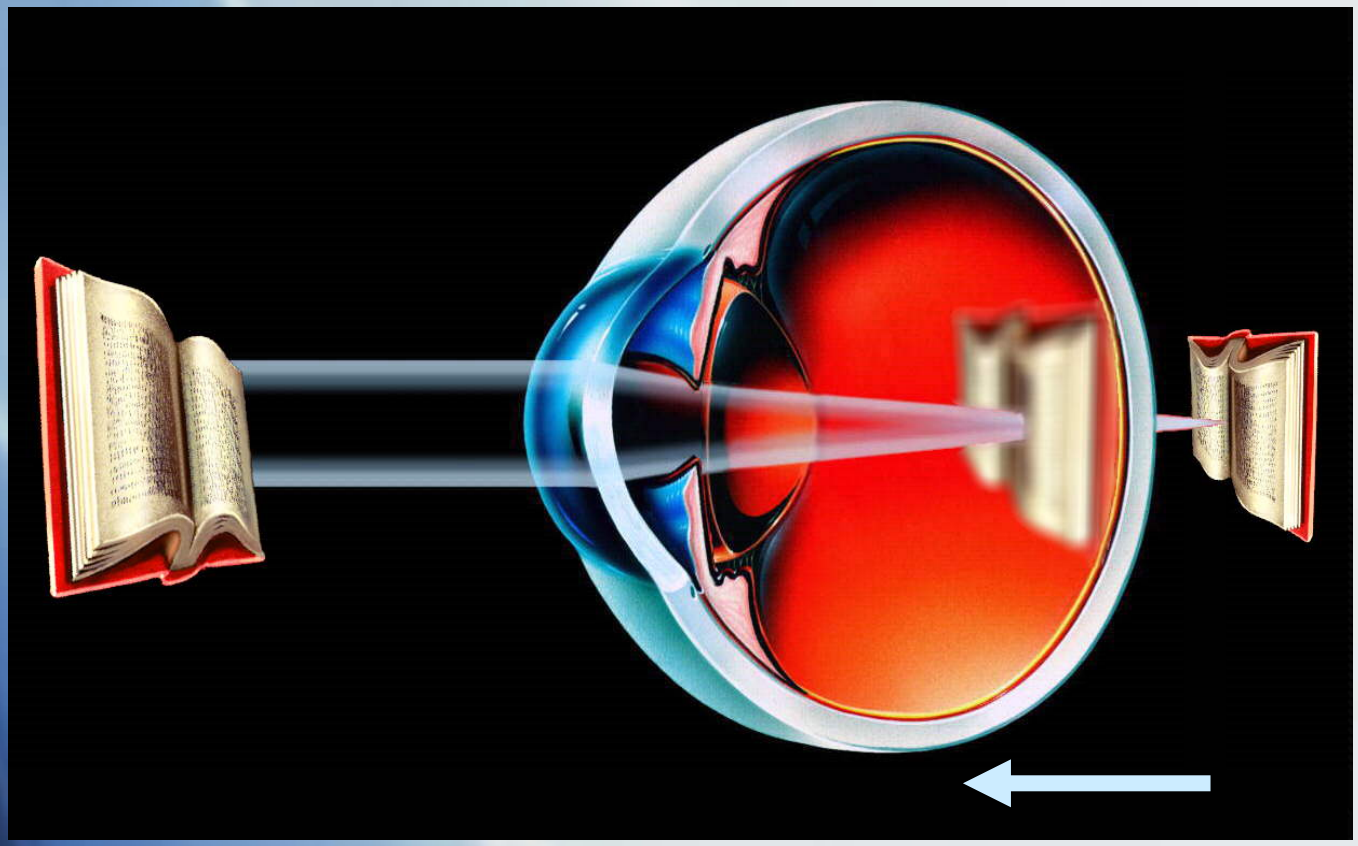
1. **myopia or nearsightedness**
2. **hyperopia or far sightedness**
3. **astigmatism, a blend of corrections.**

Myopia: Near Sighted Eye



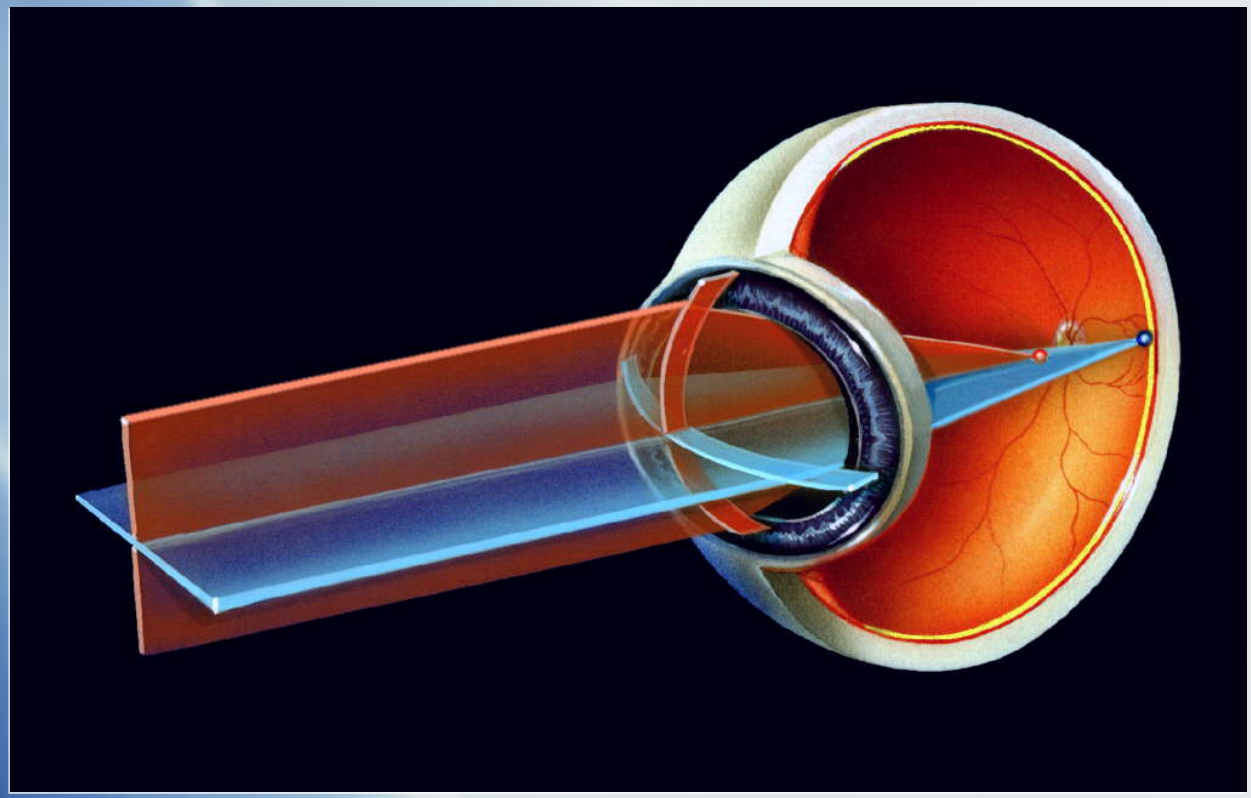
In myopia, or near sightedness, the optical power (cornea + lens) of the eye is "too powerful." The light rays from a distance object are bent too strongly and the point of focus is in front of the retina. Then the light rays start to diverge (or spread out) and by the time the rays hit the retina the image is blurry. In corneal refractive surgery, we flatten the cornea in near sightedness and lessen the "bending" of those light rays.

Hyperopia: Far Sighted Eye



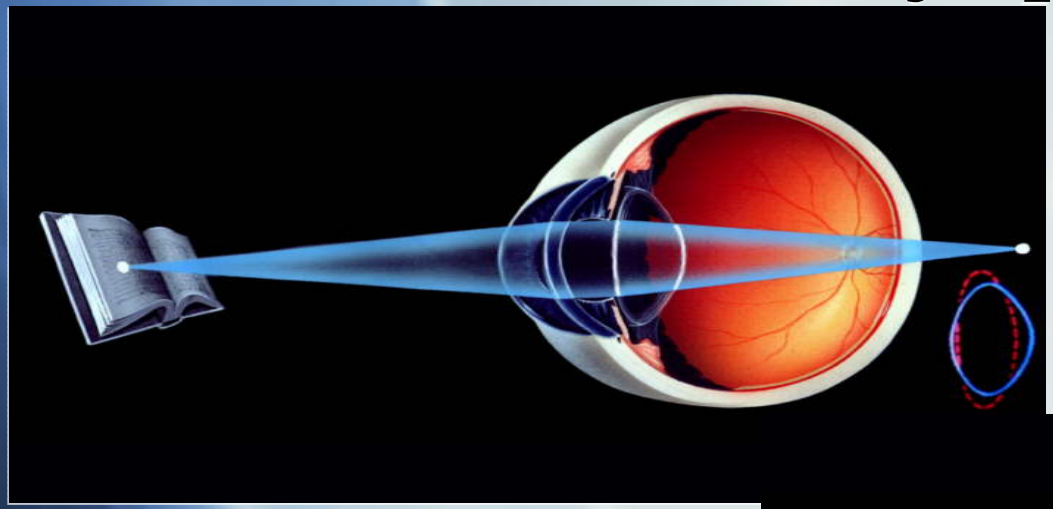
In farsightedness, the optical power of the eye is too low. The light rays from an image at distance are bent not strongly enough so the image is still a blur when it hits the retina. The best focus of that image is essentially "behind the eye". In corneal refractive surgery, we steepen the cornea in far sightedness and increase the "bending" of those light rays.

Astigmatism

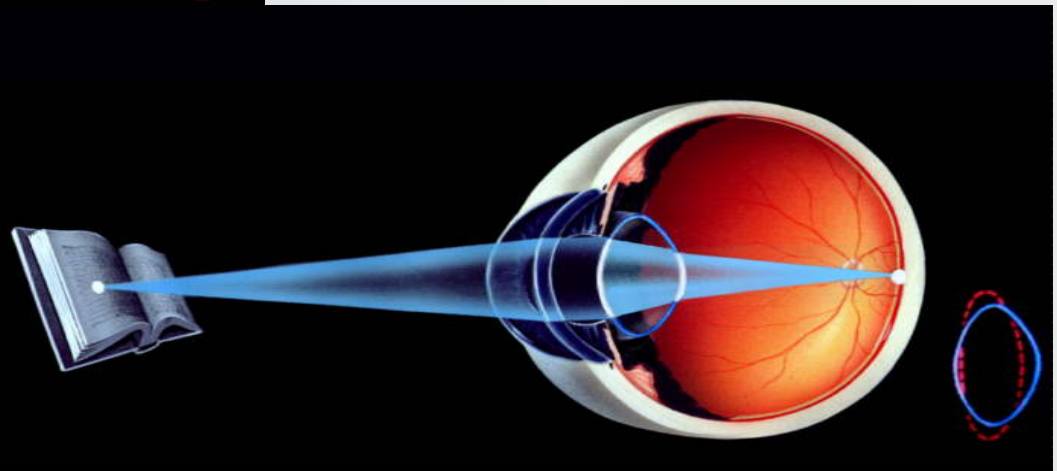


Astigmatism is a blend of corrections where the cornea is shaped more like a football than a basketball. In a basketball, the ball is the same distance and curvature from the center to any point to the equator of the basketball. In contrast, a cornea shaped like a football is steeper in one direction and flatter going the other way. For example, in the picture shown, the refractive error is one thing in the horizontal plane so all light rays entering are focused on the blue dot. 90 degrees away, the light rays entering vertically are focused at the red dot. Many people have some astigmatism. Some people have a significant amount of astigmatism.

Presbyopia



The lens changes shape (accomodates) to bring near items into focus

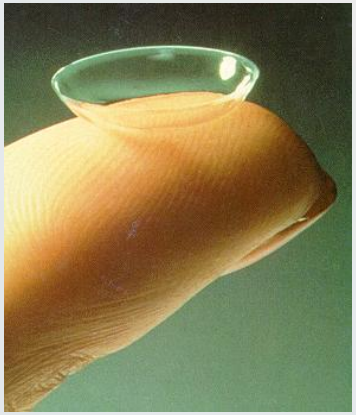


Presbyopia is when focusing on objects close up becomes difficult. This usually happens in a person's mid to late 40s. Think of focusing a camera at distance and then changing that focus to something a little closer. You have to focus the camera to keep things in focus. When someone looks far away and then tries to look at something close, the lens in the eye changes shape to allow that focusing to happen. The lens, however, looses this "elasticity" and can not change shape. It is at this point that may people will need either bifocals or readers to view objects up close. ***The AF refractive surgery program does not address this aspect of vision***. Our goal is to give our patients good distance vision. So if you are mid to late 40s (or maybe even a little younger), reading glasses will become necessary.

TREATMENT OF REFRACTIVE ERROR

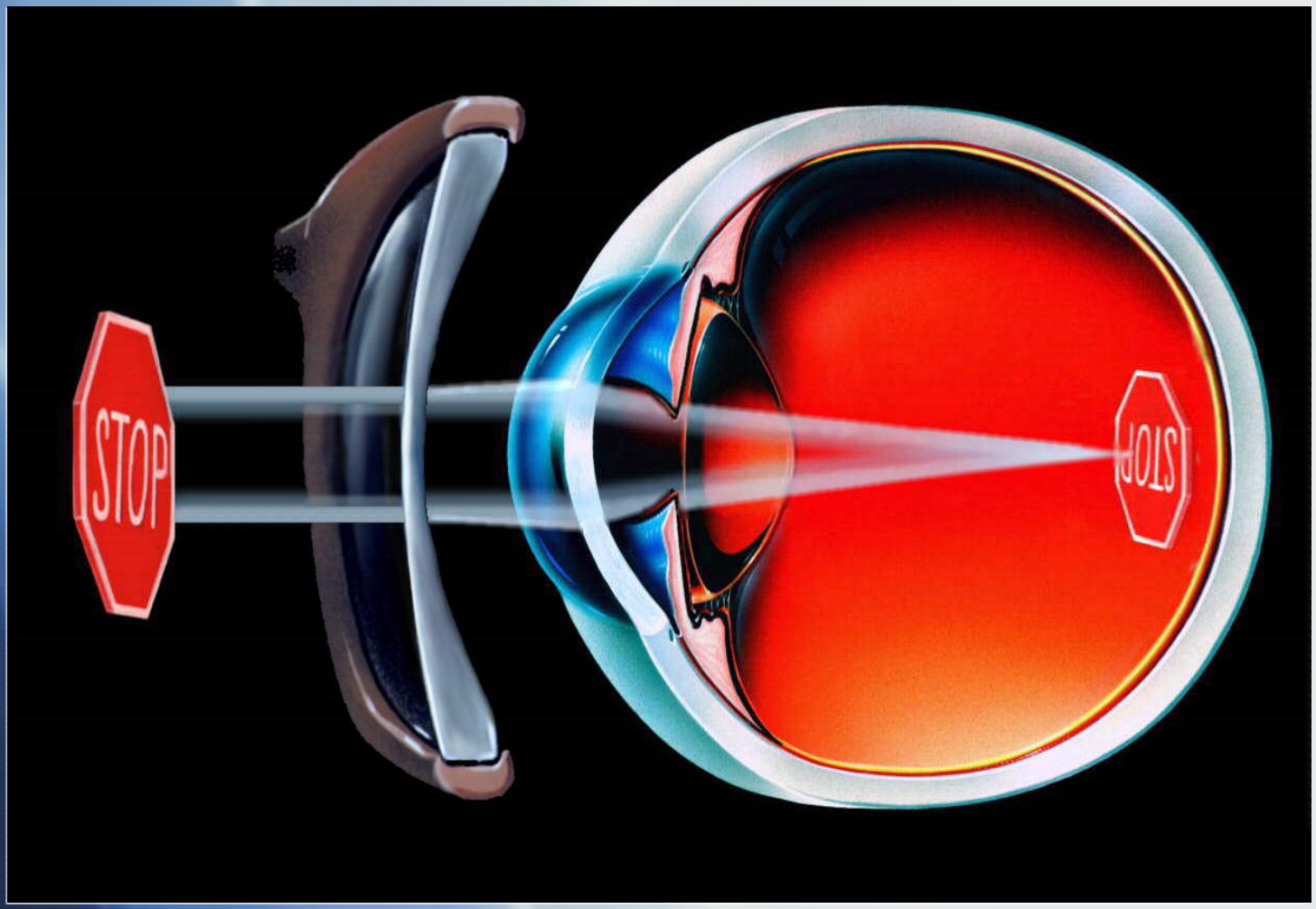
Correction of Refractive Errors

- Eyeglasses
- Contact Lenses
- Refractive Surgery



To correct for refractive error, a person can choose to wears glasses, contact lenses, or have a surgical procedure.

Spectacle Correction of Refractive Error



All three options (glasses, contact lenses, or surgery) change the amount that the light rays are bent so that the point of focus is on the retina.

Refractive Surgery

- Any surgery that changes the point of focus of the eye is called refractive surgery.

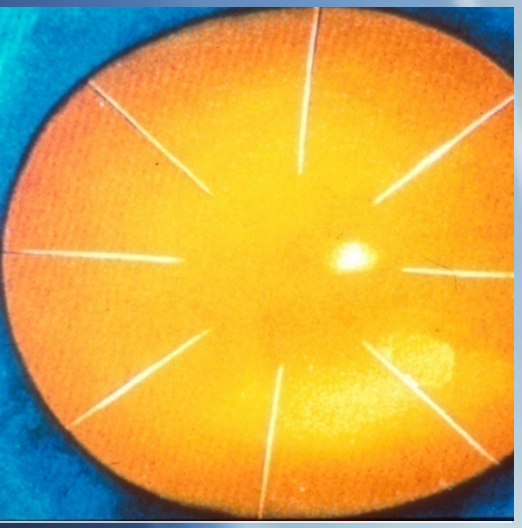
Types of Refractive Surgery

- Radial Keratotomy (RK)
- Photorefractive Keratectomy (PRK)
- Laser Assisted in-situ Keratomileusis (LASIK)
  - Wavefront-Guided Treatments:
    - Custom Cornea/Customvue
- Intrastromal Corneal Ring Segments (Intacs)
- Laser Thermal Keratoplasty (LTK) or Conductive Keratoplasty (CK)
- Phakic intra-ocular lenses
- Lensectomy/cataract extraction

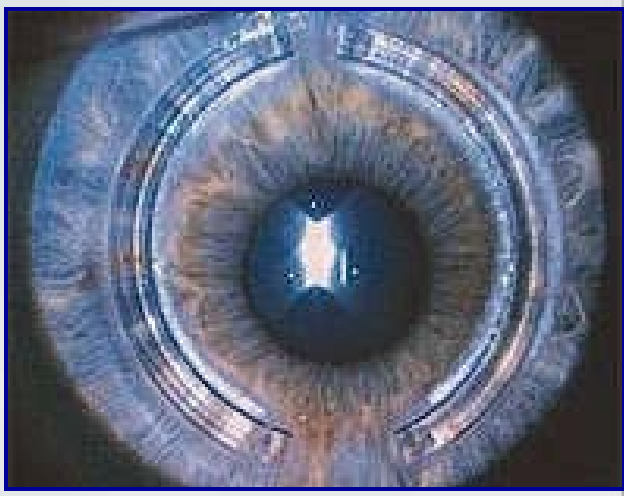
Our center offers PRK and LASIK, both laser corneal surgery.

Radial keratotomy was a procedure performed in the 1970s and is not longer performed.

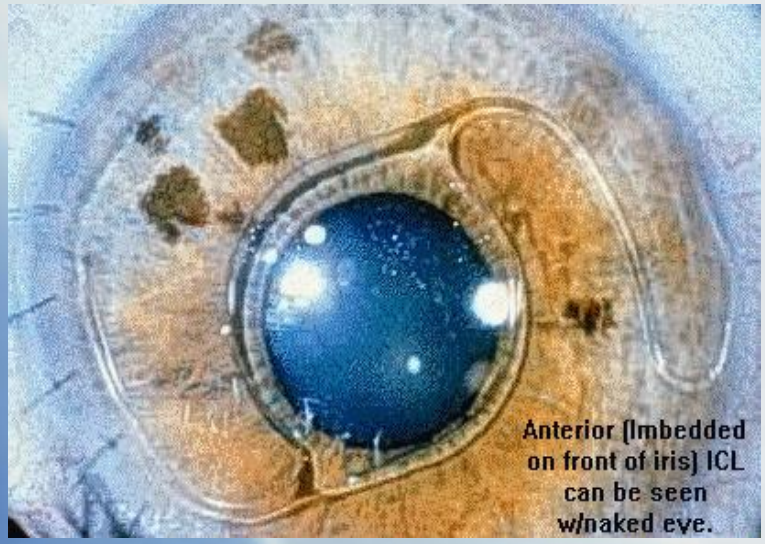
Phakic intra-ocular lenses are implantable contact lenses. We make a small incision in the cornea and place the contact lens within the eye. As of right now, this is not an approved procedure for AF personnel. It is approved for Army and Navy personnel. Even if an Air Force member is offered an implantable contact lens by another refractive center, they are not permitted to undergo this procedure.



Radial Keratotomy: No longer available



Intacs: Intrastromal corneal rings

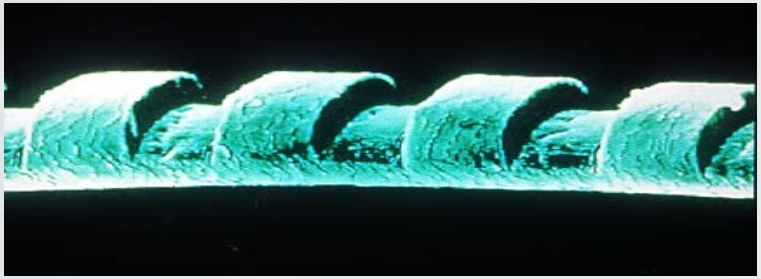


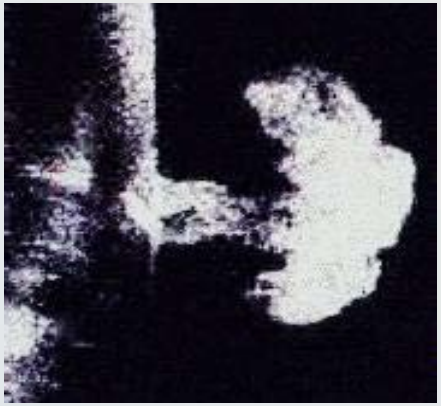
Phakic IOL: Implantable contact lens

PRK AND LASIK

Excimer LASER

- Invisible ultraviolet light
- Precisely reshapes the cornea
- FDA approved
  - myopia
  - astigmatism
  - hyperopia





The excimer laser is the laser used to shape the cornea (either flatten it in the case of nearsightedness or steepen it in the case of farsightedness) in both PRK and LASIK. The excimer laser shapes the middle, stromal layer of the cornea. It is FDA approved for use in nearsighted, farsighted, and astigmatism patients.

The top picture is a strand of human hair etched by the laser. The etchings are precise with little "collateral" damage to areas not touched by the laser. The bottom picture is the plume of ozone created by the laser

Types of Laser

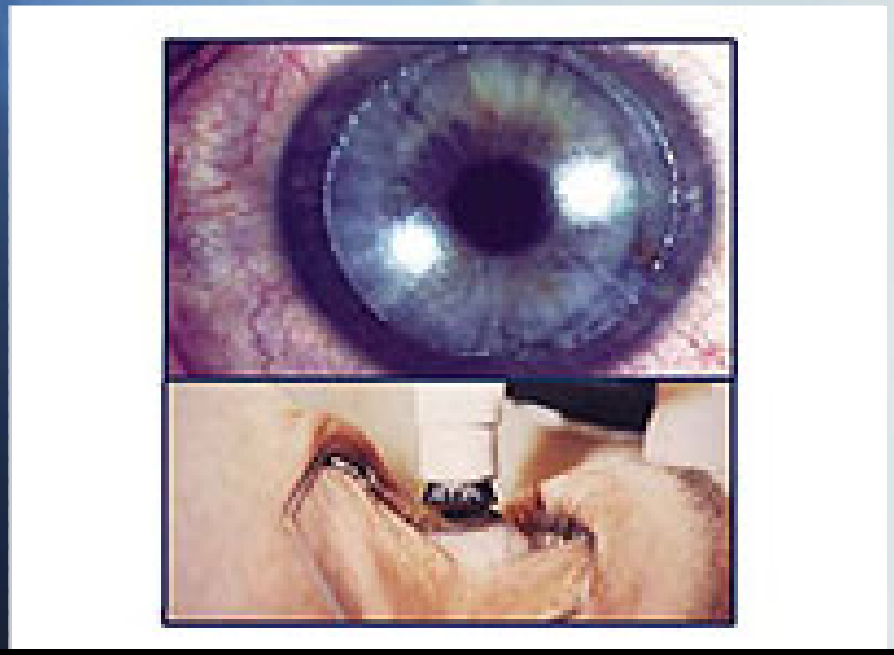
VISX Excimer Laser

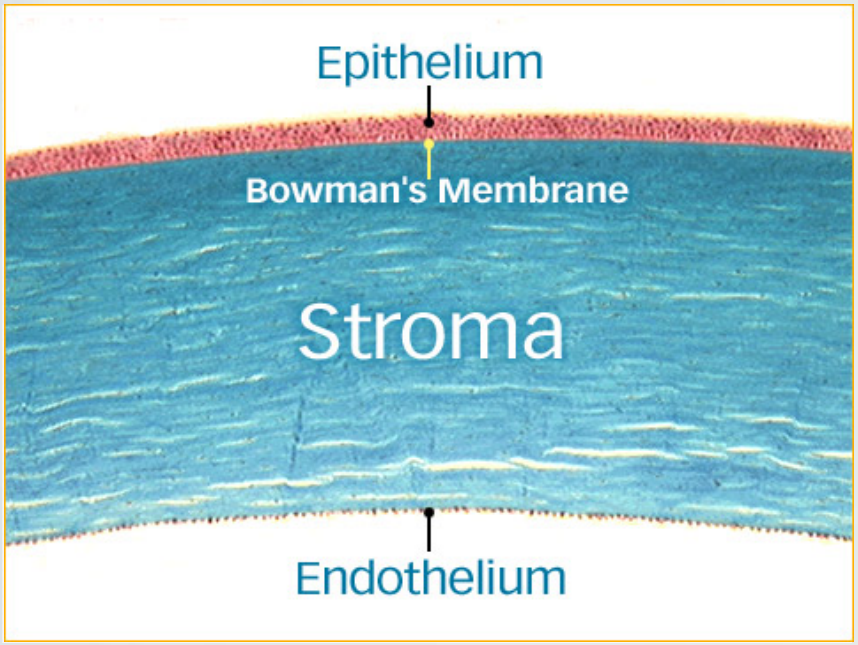
Intralase Femtosecond Laser

The laser on the left is the excimer laser used in this facility. This is the one used to shape the cornea in both PRK and LASIK. The laser on the right is the femtosecond laser. This is the laser used in this facility to create the flap of corneal tissue in LASIK.

PRK

Remove epithelium layer



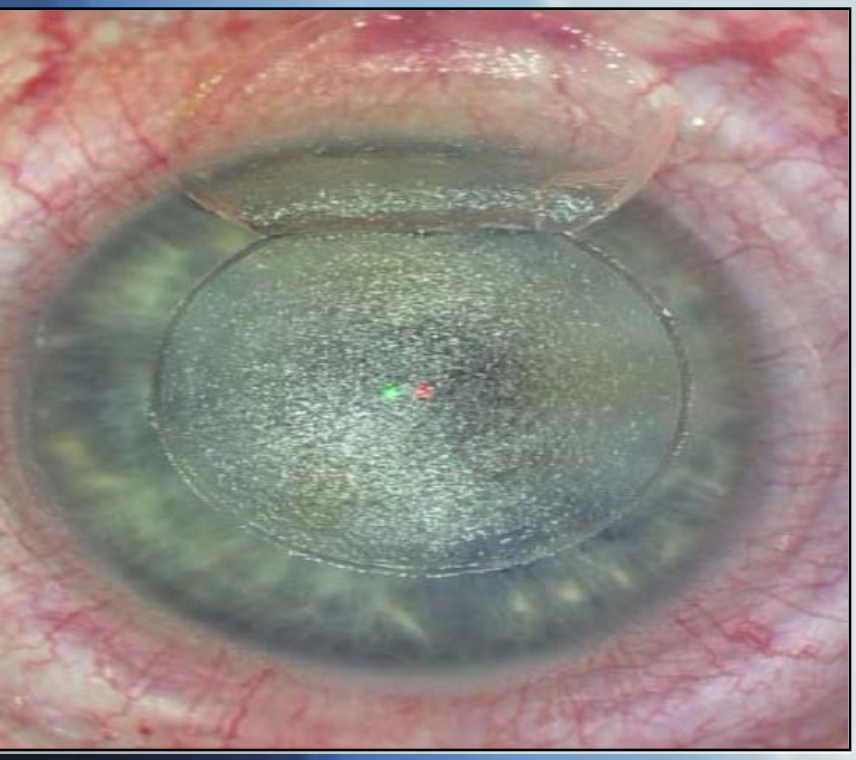


The main difference between PRK and LASIK is how we access the middle stromal layer for shaping.

In PRK, a dental like tooth brush (as seen in the bottom left hand corner) is used to remove the surface, epithelial cells. The stromal layer is then revealed. The picture in the top left shows the light reflexes off the cornea as being a little blurred. That is because the smooth epithelial layer has been removed. After epithelium removal, the excimer laser is activated to shape the stromal layer. After the laser treatment, the eye is rinsed with cool balanced salt solution and a bandage contact lens is placed over the eye. The epithelium is then allow to regenerate over the course of the next 5-6 days.

Lasik

- Picture of LASIK flap lifted revealing underlying stroma



LASIK is performed by first creating a thin flap of corneal tissue (with involves the epithelium and about 50-70 microns of the stroma) and lifting that flap away from the central cornea. The stroma that is then exposed is treated with the excimer laser to shape the cornea. The flap is then replaced back onto the central cornea.

Risks of Refractive Surgery

- The chance of having a vision reducing complication is far less than 1%.
- Should vision be compromised and you can’t do your job: may need to change career field vs medical board

Potential Risks

- Under/Overcorrection
- Regression
- Ectasia
- Night Glare/Halo
- Post Treatment Discomfort
- Dry eye
- Loss of Best Corrected Vision
- Elevation of Eye Pressure: Steroid use
- Infection: rare (1:1000 to 1:5000)
- Droopy lid, double vision, intraocular inflammation

With both PRK and LASIK there are risks.
Under or overcorrection refers to the amount of refractive error that remains after the surgery. For example, for nearsighted people, an under correction means that the patient is left a little nearsighted (things are a little blurry at distance). An over correction means that a nearsighted person may actually become farsighted after healing.
Regression means that over time the eye may develop more refractive error.
Ectasia is a rare complication where the cornea loses it's structural integrity and can start to bulge outward: leading to increased near sightedness and astigmatism requiring glasses or contact lens correction, or in worse cases corneal transplant to correct vision. We take this risk very seriously and during the preop evaluation look for any signs that your eye may be at risk for this developing.

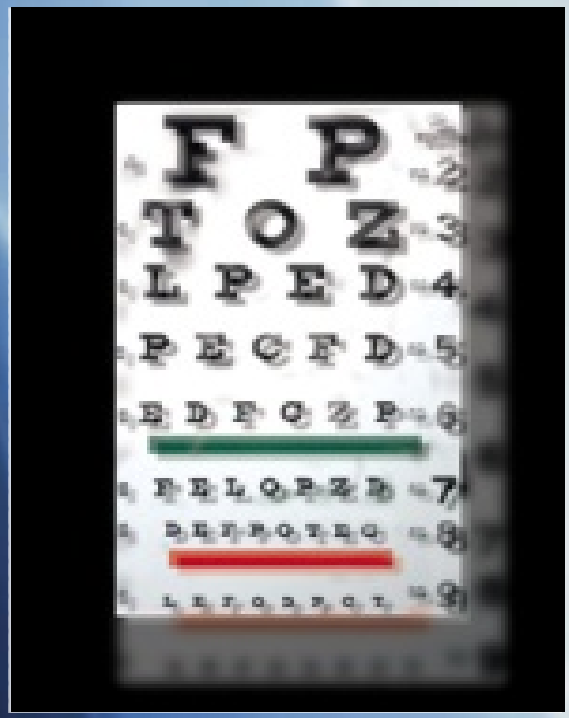
Night Glare or Halos

- Common in patients wearing glasses or contact lenses
- Normal during 1st month post-op
- May be related to pupil size and amount of correction
- Night vision improves over time; majority normal by 3rd month

Most people already have some night glare or halos already that you may notice when driving at night.

Halos

Image Ghosting/Doubling



Slight ghosting or doubling may be seen right after surgery as the corneal surface is irregular, it may also be due to a small amount of uncorrected refractive error. This is temporary and generally resolves after the first few weeks.

Post-op discomfort

- Transient
- Use medications provided to you
- Sleep is best
- Shorter duration of discomfort with LASIK vs. PRK

PRK vs. LASIK

PRK

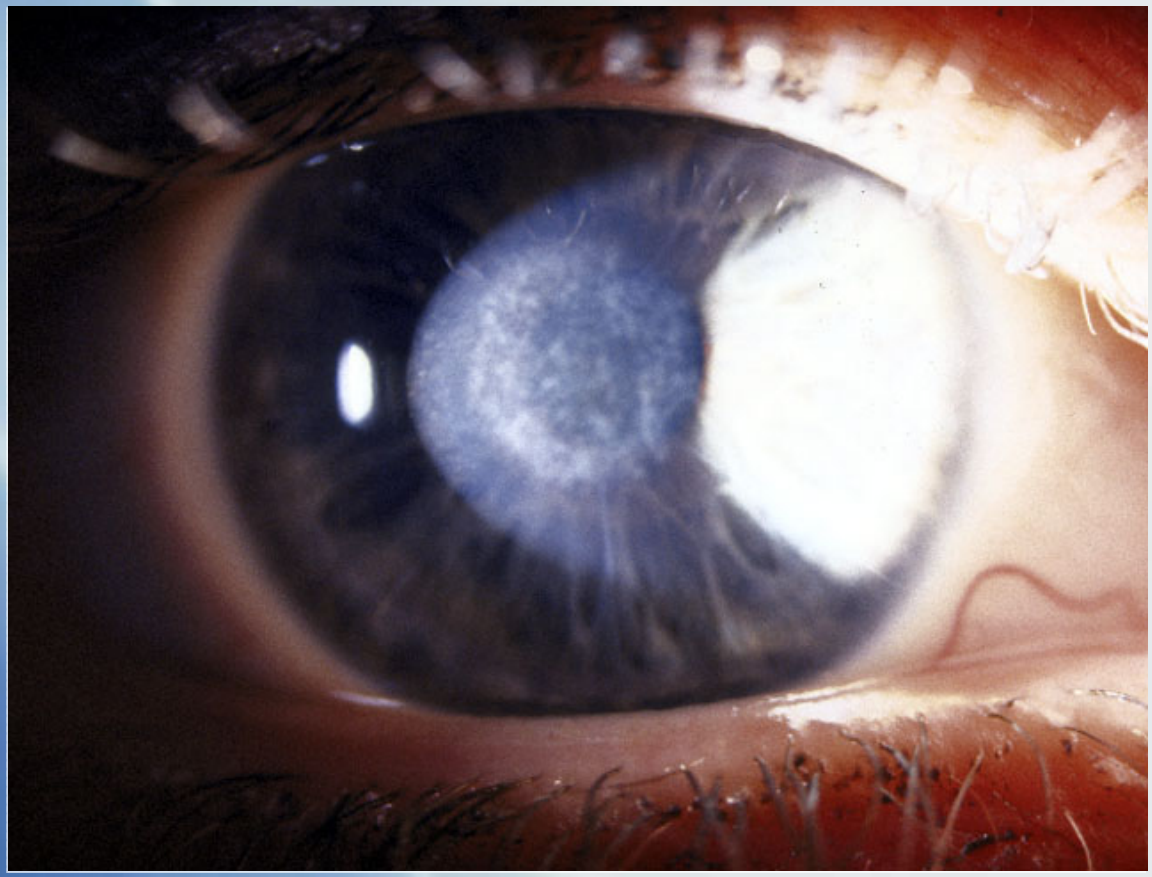
- Slower visual recovery:
- Typically able to drive by post operative week one
- Less Intra-operative/more post op discomfort
- Risk of haze (scarring) especially with high prescriptions
- Infection Rate 1:1000

LASIK

- Quicker visual recovery
- Typically driving by post operative day #2
- More Intra-operative/Less postoperative discomfort
- Less scar and haze formation with higher prescriptions
- Infection 1:5000
- Risk of Flap complications
- Causes more dry eye

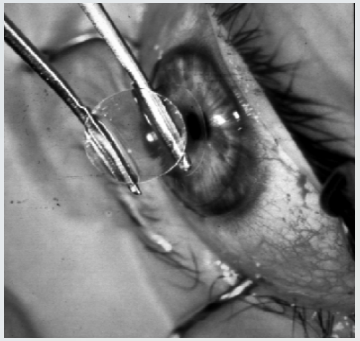
Both PRK and LASIK patients will experience dry eye symptoms following surgery, generally for the first 3-6 months, LASIK may cause more severe dry eye symptoms.

Corneal Haze (PRK)

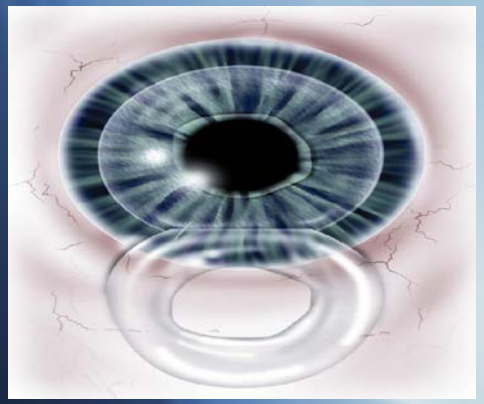


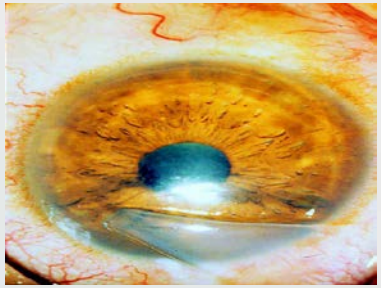
The faint greyish coloration in the center of the cornea is what we call haze. A post-op regimen of topical steroids is used to modulate the eye's healing response to prevent this from developing.

LASIK Flap Risks



- Flap complications
  - incomplete or free flaps
  - thin flap
  - button holes
  - striae and folds
  - interface inflammation
  - surface cell growth under the flap
  - flap trauma and dislocation





The extra step of creating a flap and placing it back down adds an additional layer of potential complications.

For most refractive errors, when we look at final visual outcome there is NO difference between PRK and Lasik

Both PRK and LASIK provide great visual results for the proper candidates. Your surgeon will discuss your preferences and which procedure may be best for your eye prior to surgery.

Results: Uncorrected Vision

- 99% achieve 20/40 (legal to drive)
  - Without glasses
- 92% achieve 20/20 or better
  - Without glasses

These are the results of the FDA trials that deemed PRK and LASIK safe and effective procedures.

In the Air Force, our rate of patients seeing 20/20 or better without glasses is even better: 96%

Recovery

- We can control many things:
  - Laser delivery
  - Temperature and humidity in LASER room
  - Eye Tracker
  - Medications
- We can’t control some:
  - How you heal
  - How your Cornea responds to the LASER

Post Operative Care

- Follow-up exams at
  - Day 1 (with driver) and day 3-6 (driver helpful)
  - 1, 2, 3, 6, 12, 24 months
  - ***Follow up is as important as the surgery***
- Multiple eye drops for 1-4 months
- Non-preserved artificial tears x 6+ months
- Ultraviolet avoidance (sunglasses/hat), 1+ yrs

Compliance

- If you can’t commit to proper use of post-operative medications and keeping follow-up appointments, it can adversely affect the outcome of surgery
- Most complications we see are due to the patient not using drops correctly

HOW TO APPLY FOR REFRACTIVE SURGERY

Who should not have refractive surgery?

- < 21 yr old
- Pregnant or nursing
- Unstable prescription
- Eye diseases (e.g. keratoconus, HSV/HZV, scarring)
- Family History of Keratoconus
- Immune system diseases (e.g. SLE, Grave's, CVDz)
- Specific medications
  - Accutane, Imitrex, amiodarone, steroids, anti-metabolites
- Pacemakers/electronic cardiac stimulation devices
- Smallpox vaccine (21 days pre-op until off steroids)
- Untreated dry eyes
- Unrealistic Expectations

Who is Eligible for Refractive Surgery

- All active-duty personnel
- May not deploy/PCS in post-op period (one to four months)
- Retainability requirements
  - Air Force: six months after surgery
  - Navy: twelve months
  - Army: eighteen months

What we need from you…

- Commander's Authorization
- Commander's e-mail (for profiles)
- Co-Managing Care Letter if not getting follow up at Joint Base Andrews or if PCS during post operative period
- Spectacle prescription or optometry exam *at least one year old*
- Aviators/Special Duty: need to go through flight surgeon
- Once we receive this information, will then schedule you for a pre-op examination

Pre-Op Examination

- Expect two to three hour visit, your eyes will be dilated
- Multiple measurements/tests to determine if you are a good candidate for surgery
  - Most important factor is safety

Priority

- 1: Aviators and Special Duty
  - Must get “letter to proceed” from Brooks
- 2: Personnel whose routine military duties require use of NVGs, eye protection or respiratory protection.
- 3: all others

Other Services

- We will treat any active duty member, regardless of branch of service
- Army/Navy Aviators: ask that you go through your services laser center (priority 1: there will not be a wait)
  - Walter Reed Army Medical Center at Bethesda
  - Fort Belvoir Community Hospital

Getting Care at a Civilian Facility

- PRK or LASIK are allowed at own expense
  - Must be counseled by the Health Benefits Advisor before the surgery (DoDI 1332.39, para 6.1.6).
  - Must notify their military Medical Treatment Facility (MTF) within 72 hours of being treated in a civilian facility (AFI 41-210, para 4.5)
  - Must have commander's approval and written letter to proceed.
  - Must register with the CRS Aviation Registry at the Aeromedical Consult Service at Wright Patterson Air Force Base
  - Military disability benefits not guaranteed if bad outcome
  - Active duty must take regular leave for the procedure

Profiles

PRK

- Not world wide qualified for one to four months (no deployments allowed)
- Sunglasses in uniform for one year
- No TDY/PCS within one to four months post operative

LASIK

- Not world wide qualified for one to two months (no deployments allowed)
- Sunglasses in uniform for one year
- No TDY/PCS within first month post operative

Details to consider when scheduling pre-op and surgery

- Out of soft contact lenses for 30 days and hard contact lenses for 90 days before pre-operative visit
- Driver for day of surgery, post operative visits on the first and fifth day after surgery
- Convalescent Leave = time to rest and heal, not to go on vacation

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Questions?

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