

LASIK

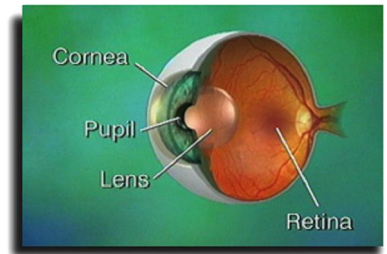
All you need to
know about
Refractive
Surgery



Refractive Surgery

Many people rely on glasses and contacts to correct their vision, but some find these methods inconvenient, uncomfortable or unattractive. **Refractive eye surgery** is a general term for surgical procedures that can improve or correct the eye's focus by permanently changing the shape of the cornea. The cornea is the clear, front surface of the eye which bends or refracts light rays as they enter the eye.

For you to see clearly, light rays must be focused by the **cornea** and **lens** to fall precisely on the **retina**, a layer of light sensing cells that lines the back of the eye. The retina converts the light rays into impulses that are sent through the optic nerve to the brain, which interprets them as images.



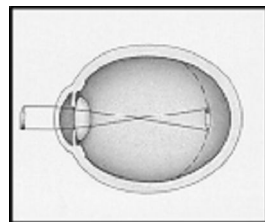
This process is very similar to the way a camera takes a picture. The cornea and lens in your eye act as the camera lens. The retina is similar to the film. If the image is not focused properly, the retina or film receives a blurry image. This condition in the human eye is known as a **refractive error**.

There are three types of refractive errors that can be corrected or reduced by refractive surgery.

Myopia

Myopia or nearsightedness is a refractive error that causes poor distance vision. If your eye is too long, or your cornea has too much focusing power, images focus in front the retina.

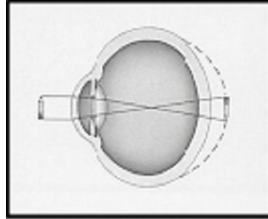
If you have myopia, light rays have past the correct focal point by the time they reach the retina. The retina then sends this "over-focused," blurry image to the brain. This condition affects over 25% of all people in the United States.



Myopia

Hyperopia

Hyperopia or farsightedness is the opposite of myopia. Distant objects are clear and close up objects appear blurry. This condition is a result of an eye that is too short or a cornea that lacks the necessary refractive power to focus images on the retina.



Hyperopia

If you have hyperopia, images focus on a point beyond the retina. This unfocused image captured by the retina is then sent to the brain and processed as an unclear picture.

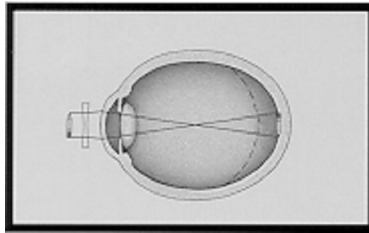
Astigmatism

Astigmatism is a condition which blurs and distorts both distant and near objects. A normal cornea is round with your cornea is shaped more like the back of a spoon, curved more in one direction than in another. Light rays have more than one focal point and focus on different areas of the retina.

Correcting Your Vision With Glasses and Contacts

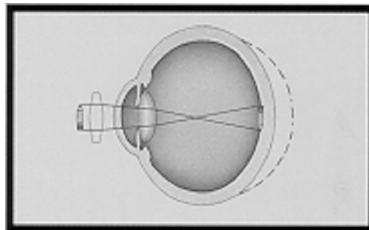
Glasses and contact lenses correct refractive errors by adding or subtracting focusing power to your cornea and lens. The power needed to focus images directly on your retina is measured in diopters. This measurement is also known as your eyeglass prescription.

If you have myopia, your cornea and lens have too much focusing power, bending light rays to meet at a point in front of the retina. Glasses and contacts compensate for this condition by subtracting power from the eye's natural focus and allowing light rays to focus further back on the retina. If you have myopia, your prescription will be negative, for example, -4.25 diopters



Myopia
correction

If you have hyperopia, glasses and contacts add focusing power, causing light rays to bend more as they enter the eye. This process moves the focal point back to the retina, allowing for clear vision. If you have hyperopia, your prescription will be positive, for example, +4.25 diopters.



Hyperopia
correction

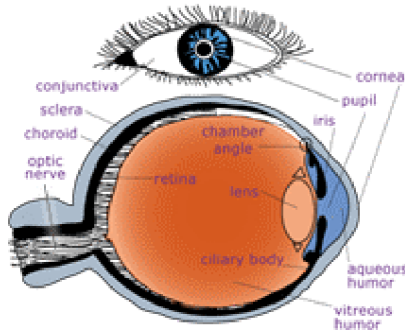
If you have astigmatism, the shape of the glass lens compensates for the uneven corneal curve and focuses the light rays to a single point on the retina.

Learning About LASIK

LASIK is a surgical procedure intended to reduce a person's dependency on glasses or contact lenses. The goal of this Web site is to provide objective information to the public about LASIK surgery. See other sections of this site to learn about what you should know before surgery, what will happen during the surgery, and what you should expect after surgery. There is a glossary of terms and a checklist of issues for you to consider, practices to follow, and questions to ask your doctor before undergoing LASIK surgery.



LASIK stands for Laser-Assisted *In Situ* Keratomileusis and is a procedure that permanently changes the shape of the cornea, the clear covering of the front of the eye, using an excimer laser. A knife, called a *microkeratome*, is used to cut a flap in the cornea. A hinge is left at one end of this flap. The flap is folded back revealing the stroma, the middle section of the cornea. Pulses from a computer-controlled laser vaporize a portion of the stroma and the flap is replaced.



What is LASIK?

The eye and vision errors

The cornea is a part of the eye that helps focus light to create an image on the retina. It works in much the same way that the lens of a camera focuses light to create an image on film. The bending and focusing of light is also known as refraction. Usually the shape of the cornea and the eye are not perfect and the image on the retina is out-of-focus (blurred) or distorted. These imperfections in the focusing power of the eye are called refractive errors. There are three primary types of refractive errors: myopia, hyperopia and astigmatism. Persons with myopia, or nearsightedness, have more

difficulty seeing distant objects as clearly as near objects. Persons with hyperopia, or farsightedness, have more difficulty seeing near objects as clearly as distant objects. Astigmatism is a distortion of the image on the retina caused by irregularities in the cornea or lens of the eye. Combinations of myopia and astigmatism or hyperopia and astigmatism are common. Glasses or contact lenses are designed to compensate for the eye's imperfections. Surgical procedures aimed at improving the focusing power of the eye are called refractive surgery. In LASIK surgery, precise and controlled removal of corneal tissue by a special laser reshapes the cornea changing its focusing power.

Other types of refractive surgery

Radial Keratotomy or RK and Photorefractive Keratectomy or PRK are other refractive surgeries used to reshape the cornea. In RK, a very sharp knife is used to cut slits in the cornea changing its shape. PRK was the first surgical procedure developed to reshape the cornea, by sculpting, using a laser. Later, LASIK was developed. The same type of laser is used for LASIK and PRK. Often the exact same laser is used for the two types of surgery. The major difference between the two surgeries is the way that the stroma, the middle layer of the cornea, is exposed before it is vaporized with the laser. In PRK, the top layer of the cornea, called the epithelium, is scraped away to expose the stromal layer underneath. In LASIK, a flap is cut in the stromal layer and the flap is folded back.

Another type of refractive surgery is thermokeratoplasty in which heat is used to reshape the cornea. The source of the heat can be a laser, but it is a different kind of laser than is used for LASIK and PRK. Other refractive devices include corneal ring segments that are inserted into the stroma and special contact lenses that temporarily reshape the cornea (orthokeratology).

What should I expect before, during, and after surgery?

What to expect before, during, and after surgery will vary from doctor to doctor and patient to patient. This section is a compilation of patient information developed by manufacturers and healthcare professionals, but cannot replace the dialogue you should have with your doctor. Read this information carefully and with the checklist, discuss your expectations with your doctor.

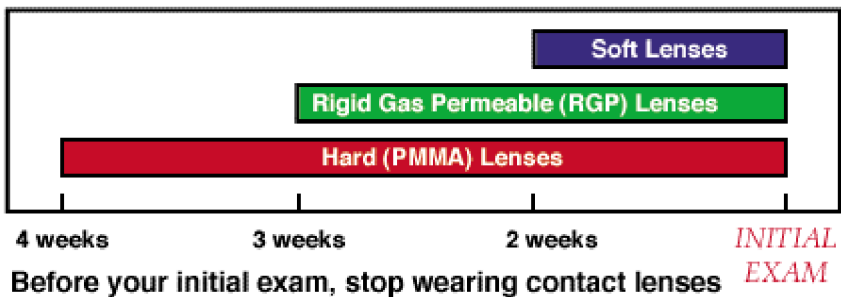
Before Surgery

If you decide to go ahead with LASIK surgery, you will need an ini-

tial or baseline evaluation by your eye doctor to determine if you are a good candidate. This is what you need to know to prepare for the exam and what you should expect:

If you wear contact lenses, it is a good idea to stop wearing them **before your baseline evaluation** and switch to wearing your glasses full-time. Contact lenses change the shape of your cornea for up to several weeks after you have stopped using them depending on the type of contact lenses you wear. Not leaving your contact lenses out long enough for your cornea to assume its natural shape before surgery can have negative consequences. These consequences include inaccurate measurements and a poor surgical plan, resulting in poor vision after surgery. These measurements, which determine how much corneal tissue to remove, may need to be repeated at least a week after your initial evaluation and before surgery to make sure they have not changed, especially if you wear RGP or hard lenses. If you wear:

- **soft contact lenses**, you should stop wearing them for 2 weeks before your initial evaluation.
- **toric soft lenses or rigid gas permeable (RGP) lenses**, you should stop wearing them for at least 3 weeks before your initial evaluation.
- **hard lenses**, you should stop wearing them for at least 4 weeks before your initial evaluation.



You should tell your doctor:

- about your past and present medical and eye conditions
- about all the medications you are taking, including over-the-counter medications and any medications you may be allergic to

Your doctor should perform a **thorough eye exam** and discuss:

- whether you are a **good candidate**
- what the risks, benefits, and alternatives of the surgery are
- what you should expect before, during, and after surgery
- what your responsibilities will be before, during, and after surgery

You should have the opportunity to ask your doctor questions during this discussion. Give yourself plenty of time to think about the risk/benefit discussion, to review any informational literature provided by your doctor, and to have any additional questions answered by your doctor before deciding to go through with surgery and **before signing the informed consent form**.

You should not feel pressured by your doctor, family, friends, or anyone else to make a decision about having surgery. Carefully consider the pros and cons.

The **day before surgery**, you should stop using:

- creams
- lotions
- makeup
- perfumes

These products as well as debris along the eyelashes may increase the risk of infection during and after surgery. Your doctor may ask you to scrub your eyelashes for a period of time before surgery to get rid of residues and debris along the lashes.

Also **before surgery**, arrange for transportation to and from your surgery and your first follow-up visit. On the day of surgery, your doctor may give you some medicine to make you relax. Because this medicine impairs your ability to drive and because your vision may be blurry, even if you don't drive make sure someone can bring you home after surgery.

During Surgery

The surgery should take less than 30 minutes. You will lie on your back in a reclining chair in an exam room containing the laser system. The laser system includes a large machine with a microscope attached to it and a computer screen.

A numbing drop will be placed in your eye, the area around your eye will be cleaned, and an instrument called a lid speculum will be used to hold your eyelids open. A ring will be placed on your eye and very high pressures will be applied to create suction to the cornea. Your vision will dim while the suction ring is on and you may feel the pressure and experience some discomfort during this part of the procedure. The microkeratome, a cutting instrument, is attached to the suction ring. Your doctor will use the blade of the microkeratome to cut a flap in your cornea.

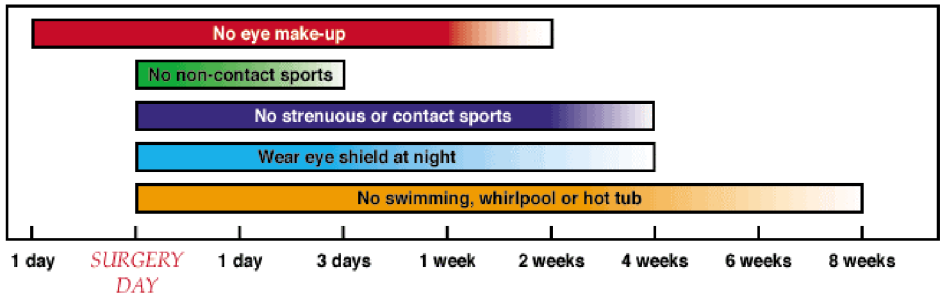
The microkeratome and the suction ring are then removed. You will be able to see, but you will experience fluctuating degrees of blurred vision during the rest of the procedure. The doctor will then lift the flap and fold it back on its hinge, and dry the exposed tissue.

The laser will be positioned over your eye and you will be asked to stare at a light. This is **not** the laser used to remove tissue from the cornea. This light is to help you keep your eye fixed on one spot once the laser comes on. **NOTE:** If you cannot stare at a fixed object for at least 60 seconds, you may not be a good candidate for this surgery.

When your eye is in the correct position, your doctor will start the laser. At this point in the surgery, you may become aware of new sounds and smells. The pulse of the laser makes a ticking sound. As the laser removes corneal tissue, some people have reported a smell similar to burning hair. A computer controls the amount of laser delivered to your eye. Before the start of surgery, your doctor will have programmed the computer to vaporize a particular amount of tissue based on the measurements taken at your initial evaluation. After the pulses of laser energy vaporize the corneal tissue, the flap is put back into position.

A shield should be placed over your eye at the end of the procedure as protection, since no stitches are used to hold the flap in place. It is important for you to wear this shield to prevent you from rubbing your eye and putting pressure on your eye while you sleep, and to

protect your eye from accidentally being hit or poked until the flap has healed.

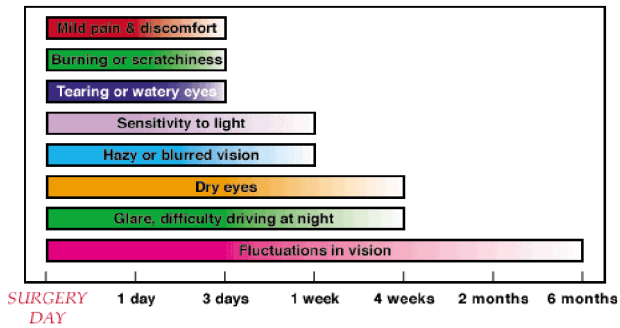


Good practices to follow before and after surgery

After Surgery

Immediately after the procedure, your eye may burn, itch, or feel like there is something in it. You may experience some discomfort, or in some cases, mild pain and your doctor may suggest you take a mild pain reliever. Both your eyes may tear or water. Your vision will probably be hazy or blurry. You will instinctively want to rub your eye, but don't! Rubbing your eye could dislodge the flap, requiring further treatment. In addition, you may experience sensitivity to light, glare, starbursts or haloes around lights, or the whites of your eye may look red or bloodshot. These symptoms should improve considerably within the first few days after surgery. You should plan on taking a few days off from work until these symptoms subside. **You should contact your doctor immediately** and not wait for your scheduled visit, if you experience severe pain, or if your vision or other symptoms get worse instead of better.

You should see your doctor within the **first 24 to 48 hours** after surgery and at regular intervals after that for at least the first six months. At the first postoperative visit, your doctor will remove the eye shield, test your vision, and examine your eye. Your doctor may give you one or more types of eye drops to take at home to help prevent infection and/or inflammation. You may also be advised to use artificial tears to help lubricate the eye. Do not resume wearing a contact lens in the operated eye, even if your vision is blurry.



What to expect after surgery

You should wait **one to three days** following surgery before beginning any non-contact sports, depending on the amount of activity required, how you feel, and your doctor's instructions.

To help prevent infection, you may need to wait for up to **two weeks after surgery or until your doctor advises you otherwise** before using lotions, creams, or make-up around the eye. Your doctor may advise you to continue scrubbing your eyelashes for a period of time after surgery. You should also avoid swimming and using hot tubs or whirlpools for 1-2 months.

Strenuous contact sports such as boxing, football, karate, etc. should not be attempted for at least **four weeks** after surgery. It is important to protect your eyes from anything that might get in them and from being hit or bumped.

During the **first few months** after surgery, your vision may fluctuate.

- It may take up to three to six months for your vision to stabilize after surgery.
- Glare, haloes, difficulty driving at night, and other visual symptoms may also persist during this stabilization period. If further correction or enhancement is necessary, you should wait until your eye measurements are consistent for two consecutive visits at least 3 months apart before re-operation.
- It is important to realize that although distance vision may improve after re-operation, it is unlikely that other visual symptoms such as glare or haloes will improve.

- It is also important to note that no laser company has presented enough evidence for the FDA to make conclusions about the safety or effectiveness of enhancement surgery.

Contact your eye doctor immediately, if you develop any new, unusual or worsening symptoms at any point after surgery. Such symptoms could signal a problem that, if not treated early enough, may lead to a loss of vision.

What are the risks ?

Most patients are very pleased with the results of their refractive surgery. However, like any other medical procedure, there are risks involved. That's why it is important for you to understand the limitations and possible complications of refractive surgery.

Before undergoing a refractive procedure, you should carefully weigh the risks and benefits based on your own personal value system, and try to avoid being influenced by friends that have had the procedure or doctors encouraging you to do so.

- **You may be undertreated or overtreated.** Only a certain percent of patients achieve 20/20 vision without glasses or contacts. You may require additional treatment, but additional treatment may not be possible. You may still need glasses or contact lenses after surgery. This may be true even if you only required a very weak prescription before surgery. If you used reading glasses before surgery, you will still need reading glasses after surgery.
- **Results are generally not as good in patients with very small amounts of astigmatism or very large refractive errors of any type.** You should discuss your expectations with your doctor and realize that you may still require glasses or contacts after the surgery.
- **Results may not be lasting.** The level of improved vision you experience after surgery may be temporary, especially if you are farsighted or currently need reading glasses. It is especially important for farsighted individuals to have a cycloplegic refraction (a vision exam with lenses after dilating drops) as part of the screening process. Patients whose manifest refraction (a vision exam

with lenses before dilating drops) is very different from their cycloplegic refraction are more likely to have temporary results.

- **Some patients lose vision.** Some patients lose lines of vision on the vision chart that cannot be corrected with glasses, contact lenses, or surgery as a result of treatment. There is little known about how refractive procedures affect other aspects of vision, such as contrast sensitivity (the ability to see objects clearly against a similar background or in dim lighting conditions). Some studies suggest that patients do not see as well in situations of low contrast, such as at night or in fog, after treatment as compared to before treatment. Therefore, patients with low contrast sensitivity to begin with probably should not have a refractive procedure. It is important for you to know that not all eye centers test contrast sensitivity, and that when it is tested, it should be done in a dark room.
- **Some patients may develop severe dry eye syndrome.** As a result of surgery, your eye may not be able to produce enough tears to keep the eye moist and comfortable. This condition may be permanent. Intensive drop therapy and the use of plugs or other procedures may be required.

Additional Risks if you are Considering the Following:

- **Monovision**

Monovision is one clinical technique used to deal with the correction of presbyopia, the gradual loss of the ability of the eye to change focus for close-up tasks that progresses with age. The intent of monovision is for the presbyopic patient to use one eye for distance viewing and one eye for near viewing. This practice was first applied to fit contact lens wearers and more recently to LASIK and other refractive surgeries. With contact lenses, a presbyopic patient has one eye fit with a contact lens to correct distance vision, and the other eye fit with a contact lens to correct near vision. In the same way, with LASIK, a presbyopic patient has one eye operated on to correct the distance vision, and the other operated on to correct the near vision. In other words, the goal of the surgery is for one eye to have vision **worse than 20/20**, the commonly referred to goal for LASIK surgical correction of distance vision. Since one eye is corrected for distance viewing and the other

eye is corrected for near viewing, the two eyes no longer work together. This results in poorer quality vision and a decrease in depth perception. These effects of monovision are most noticeable in low lighting conditions and when performing tasks requiring very sharp vision. Therefore, you may need to wear glasses or contact lenses to fully correct both eyes for distance or near when performing visually demanding tasks, such as driving at night, operating dangerous equipment, or performing occupational tasks requiring very sharp close vision (e.g., reading small print for long periods of time).

Many patients cannot get used to having one eye blurred at all times. The difference between monovision with contact lenses and monovision with LASIK is that you can always take contact lenses out or have them changed (the treatment is reversible and adjustable) as opposed to LASIK, where the result of the surgery is **not** reversible or adjustable. Therefore, if you are considering monovision with LASIK, make sure you go through a trial period with contact lenses to see if you can tolerate monovision, before having the irreversible surgery performed on your eyes. Just before this trial period starts, find out if you pass your state's driver's license requirements with monovision, or if you need supplemental glasses to drive.

In addition, you should consider how much your presbyopia is expected to increase in the future. Ask your doctor when you should expect the results of your monovision surgery to no longer be enough for you to see near-by objects clearly without the aid of glasses or contacts, or when a second surgery might be required to further correct your near vision.

- **Bilateral Simultaneous Treatment**

You may choose to have LASIK surgery on both eyes at the same time or to have surgery on one eye at a time. Although the convenience of having surgery on both eyes on the same day is attractive, this practice is riskier than having two separate surgeries. The second eye may have a higher risk of developing an inflammation if surgery is done on the same day than if surgery is performed on separate days. If a malfunction of the laser or microkeratome occurs causing a complication with the first eye, the second eye is more likely to also experience the same complication if the surgery is performed on the same day rather than on separate days.

If you decide to have one eye done at a time, you and your doctor will decide how long to wait before having surgery on the other eye. If both eyes are treated at the same time or before one eye has a chance to fully heal, you and your doctor do not have the advantage of being able to see how the first eye responds to surgery before the second eye is treated.

Another disadvantage to having surgery on both eyes at the same time is that the vision in both eyes may be blurred after surgery until the initial healing process is over, rather than being able to rely on clear vision in at least one eye at all times.

Finding the Right Doctor

If you are considering refractive surgery, make sure you:

- **Compare.** The levels of risk and benefit vary slightly not only from procedure to procedure, but from device to device depending on the manufacturer, and from surgeon to surgeon depending on their level of experience with a particular procedure.
- **Don't base your decision simply on cost** and don't settle for the first eye center, doctor, or procedure you investigate. Remember that the decisions you make about your eyes and refractive surgery will affect you for the rest of your life.
- Be wary of eye centers that advertise, "20/20 vision or your money back" or "package deals." There are **never any guarantees** in medicine.
- **Read.** It is important for you to read the patient handbook provided to your doctor by the manufacturer of the device used to perform the refractive procedure. Your doctor should provide you with this handbook and be willing to discuss his/her outcomes (successes as well as complications) compared to the results of studies outlined in the handbook.

Even the best screened patients under the care of most skilled surgeons can experience serious complications.

- **During surgery.** Malfunction of a device or other error, such as cutting a flap of cornea through and through instead of making a hinge during LASIK surgery, may lead to

discontinuation of the procedure or irreversible damage to the eye.

- **After surgery.** Some complications, such as migration of the flap, inflammation or infection, may require another procedure and/or intensive treatment with drops. Even with aggressive therapy, such complications may lead to temporary loss of vision or even irreversible blindness.

Under the care of an experienced doctor, carefully screened candidates with reasonable expectations and a clear understanding of the risks and alternatives are likely to be happy with the results of their refractive procedure.

Advertising

Be cautious about "slick" advertising and/or deals that sound "too good to be true." Remember, they usually are. There is a lot of competition resulting in a great deal of advertising and bidding for your business. Do your homework.

If you want to know more about advertising ethics, do's and don'ts, or want to report on false advertising, explore the following websites:

- <http://www.ftc.gov/bcp/menu-ads.htm>
- <http://www.ftc.gov/bcp/menu-health.htm>

LASIK Surgery Checklist

Know what makes you a poor candidate

Career impact - does your job prohibit refractive surgery?

Cost - can you really afford this procedure?

Medical conditions - e.g., do you have an autoimmune disease or other major illness? Do you have a chronic illness that might slow or alter healing?

Eye conditions - do you have or have you ever had any problems with your eyes other than needing glasses or contacts?

Medications - do you take steroids or other drugs that might prevent healing?

Stable refraction - has your prescription changed in the last year?

High or Low refractive error - do you use glasses/contacts only some of the time? Do you need an unusually strong prescription?

Pupil size - are your pupils extra large in dim conditions?

Corneal thickness - do you have thin corneas?

Know all the risks and procedure limitations

Overtreatment or undertreatment - are you willing and able to have more than one surgery to get the desired result?

May still need reading glasses - do you have presbyopia?

Results may not be lasting - do you think this is the last correction you will ever need? Do you realize that long-term results are not known?

May permanently lose vision - do you know some patients may lose some vision or experience blindness?

Development of visual symptoms - do you know about glare, halos, starbursts, etc. and that night driving might be difficult?

Contrast sensitivity - do you know your vision could be significantly reduced in dim light conditions?

Bilateral treatment - do you know the additional risks of having both eyes treated at the same time?

Patient information - have you read the patient information booklet about the laser being used for your procedure?

Know how to find the right doctor

Experienced - how many eyes has your doctor performed LASIK surgery on with the same laser?

Equipment - does your doctor use an FDA-approved laser for the procedure you need?

Informative - is your doctor willing to spend the time to answer all your questions?

Long-term Care - does your doctor encourage follow-up and management of you as a patient? Your preop and postop care may be provided by a doctor other than the surgeon.

Be Comfortable - do you feel you know your doctor and are comfortable with an equal exchange of information?

Know preoperative, operative, and postoperative expectations

No contact lenses prior to evaluation and surgery - can you go for an extended period of time without wearing contact lenses?

Have a thorough exam - have you arranged not to drive or work after the exam?

Read and understand the informed consent - has your doctor given you an informed consent form to take home and answered all your questions?

No makeup before surgery - can you go 24-36 hours without makeup prior to surgery?

Arrange for transportation - can someone drive you home after surgery?

Plan to take a few days to recover - can you take time off to take it easy for a couple of days if necessary?

Expect not to see clearly for a few days - do you know you will not see clearly immediately?

Know sights, smells, sounds of surgery - has your doctor made you feel comfortable with the actual steps of the procedure?

Be prepared to take drops/medications - are you willing and able to put drops in your eyes at regular intervals?

Be prepared to wear an eye shield - do you know you need to protect the eye for a period of time after surgery to avoid injury?

Expect some pain/discomfort - do you know how much pain to expect?

Know when to seek help - do you understand what

problems could occur and when to seek medical intervention?

Know when to expect your vision to stop changing - are you aware that final results could take months?

Make sure your refraction is stable before any further surgery - if you don't get the desired result, do you know not to have an enhancement until the prescription stops changing?



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