FORESIGHT

WHAT EVERY PATIENT NEEDS TO KNOW
ABOUT
COMMON EYE DISEASES

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TO ALL THOSE PATIENTS

WHO PLACE THEIR TRUST IN US

TO PROVIDE THE HIGHEST QUALITY CARE

FOR THEIR EYES.

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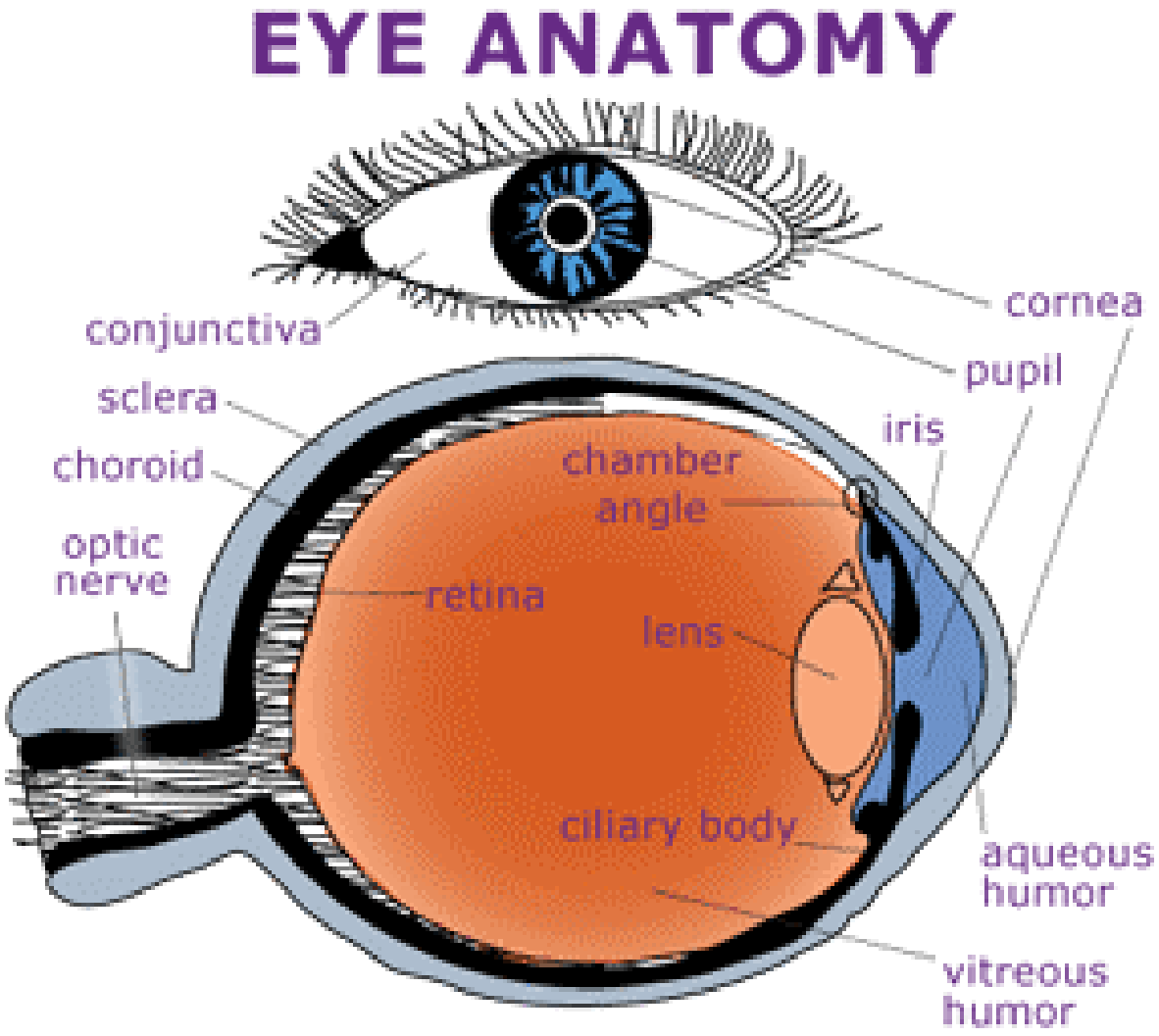


Figure 1. Anatomy of Human Eye

I. INTRODUCTION

The human eye is extremely versatile. It can discern a golf ball more than 300 yards away and then change focus to read a golf score card held a few inches away. It can adjust to a thousand-fold variation in the intensity of light and distinguish many hundreds of color variations.

The eye is an organ, which is uniquely accessible to medical examination. It is the only part of the body which has a window – the transparent cornea. Unlike other organs in the body, the inside of the eye can be directly examined using special magnifying instrumentation, without the need for X-rays, laboratory tests, or exploratory surgery. This further augments the ability to diagnose, observe and in most cases, treat conditions in the eye.

Figure 1 shows the general arrangement of its basic components. The eye is an almost spherical jelly-like mass contained within a tough shell, called the sclera. Except for the front portion, or the cornea which is transparent, the sclera is white and opaque. Bulging upward from the body of the sphere, the cornea's curved surface serves as the first and strongest refractive surface of the eye's lens system. Most of the bending of light, entering the eye, takes place at this air-cornea surface. It is this surface that undergoes direct treatment during LASIK. When light passes through the cornea, it then encounters a chamber filled with a clear watery fluid called the aqueous humor. Immersed in this aqueous humor is the iris, which controls the amount of light passing through its central hole or pupil. It is the iris which gives the eye its characteristic blue, brown, hazel, or green color. Made up of circular and radial muscles, the iris can expand or contract the pupil over a range, from about 2 mm in bright sunlight to roughly 8 mm in diameter in the dark of night. Immediately behind the iris, is the crystalline lens. This lens has the size and shape of a small bean. The lens provides the fine focusing, performed by automatically changing its shape, that allows us to see both near and far objects. A cataract is simply a clouding of this lens that prevents light from reaching the retina at the rear-most end of the eye. Behind the lens is another chamber filled with a transparent gelatinous substance called the vitreous humor. At the other end of the vitreous humor is the light-sensitive part of the

eye, known as the retina. Just about at the center of the retina is a small depression from 2.5 – 3 mm in diameter known as the macula. This region provides the sharpest and most detailed information compared to other regions of the retina, which provide general peripheral vision. The actual perception of a scene is constructed by the combination of the eye and brain system, via the optic nerve.

Aging causes many expected changes in the human eye. A natural change, which we all experience after the age of 40 –45, is the inability to see things up close. This condition is known as Presbyopia and is related to the inability of the crystalline lens to change shape as readily as it once did. The most popular way of offsetting the effect of Presbyopia is to wear reading glasses or bifocals.

While there are many age related eye problems discussed in this book, the three most common problems are Cataracts, Glaucoma and age-related Macular Degeneration. Cataracts can be reversed; Glaucoma can be treated or prevented in some cases; Macular Degeneration can run a slow, gradual and progressively worsening course. About a third of all seniors complaining of visual problems actually suffer from cataracts while an equal number suffer from some degree of age-related Macular Degeneration. Approximately 5 percent suffer from a specific form of Glaucoma.

As more of us live longer, the incidents of various types of eye problems increase. Increasingly, many seniors apply eye drops, either prescribed or as self-medication. It is important that we all receive adequate advice. A thorough explanation of the problem or disease will not only improve his/her understanding of the disease, but it will also serve to reduce the individual's anxiety, and, with the help of any eye-care professional, lead to the most expeditious solution to the problem.

This book is about Cataracts, Dry Eye, Glaucoma, retinal problems such as age-related Macular Degeneration and others. It has been written in order to give you a more complete understanding of these conditions and knowledge of what can be done to help preserve or restore normal vision, where possible. This book is not meant to take the place of a discussion with your doctor.

Rather, it will supply you with the basic information that every person with an eye disorder should know so that you can more effectively discuss your individual needs and concerns.

II. CATARACTS

What is a cataract and what causes it?

The lens, which lies behind the iris and the aqueous humor (see Figure 1), works much like a camera lens. It focuses light onto the retina at the back of the eye, where an image is recorded. The lens also adjusts the eye's focus, letting us see things clearly both up close and far away. The lens is made of mostly water and protein. The protein is arranged in a precise way that keeps the lens clear and lets light pass through it.

As we age, some of the protein may clump together and start to cloud a small area of the lens. This is a cataract. The clouding actually results from the breakdown of protein molecules. Over time, the cataract may grow larger and cloud more of the lens, making it harder to see. Scientists suspect that there are several causes of cataracts, such as smoking and diabetes. Or, it may be that the protein in the lens just changes from the wear and tear it takes over the years.

When are you most likely to have a cataract?

The term "age-related" is a little misleading. You don't have to be a senior citizen to get this type of cataract. In fact, people can have an age-related cataract in their 40s and 50s. But during middle age, most cataracts are small and do not affect vision. It is usually after age 60 that most cataracts actually affect vision.

What are its symptoms?

A cataract starts out small; it has little effect on vision at first. You may notice that your vision is blurred a little, like looking through a cloudy piece of glass. A cataract may make light from the sun or a lamp seem too bright, causing glare. Or, you may notice when you drive at night that the oncoming headlights cause more glare than before. Also, colors may not appear as bright to you as they once did. As the cataract gets bigger and clouds more of the lens (doctors use the term, "ripens"), you will find it harder to read and do other normal tasks. The word "cataract" means waterfall. For people with a ripe cataract, it is like trying to see through a waterfall.

Like gray hair, cataracts are not a disease. Most cataracts result simply from the natural aging process of the human crystalline lens.

How is a cataract detected?

Although you might think you have a cataract, the only way to know for sure is by having an eye examination. Should your eye care professional find one, he or she can monitor it and advise you about appropriate future treatment, some of which are described in detail below.

How is a cataract treated?

It is treated with surgery. Your eye surgeon will remove your clouded lens and, in most cases, replace it with a clear, plastic, artificial lens. Cataract surgery is very successful in restoring vision. In fact, it is one of the most common surgeries performed in the United States, with over 1.5 million cataract surgeries done each year.

How Exactly Does Your Eye Surgeon Remove Your Cataracts?

The most commonly employed technique is called extracapsular cataract extraction.

Imagine the cloudy lens or cataract as a miniature grape suspended inside the eyeball. The grape has skin (capsule) and pulp inside (cloudy lens). A small incision is made into the skin of the grape (capsule) and the pulp (cloudy lens) removed. An artificial intraocular lens is then surgically inserted into the transparent empty sac or capsular bag. This technique allows for the permanent intraocular lens to be suspended in the eye using the same natural support system as the original human lens, thereby reducing the potential for collateral complications with either the retina or the cornea.

A sophisticated version of this extracapsular technique is called **phacoemulsification**. This method enables the surgeon to remove the cataract through a much tinier incision of approximately 3 mm (about an 1/8 of an inch) instead of the routine 11 mm (about 1/2 inch). What makes this smaller incision possible is a surgical probe, whose size is about the tip of a ballpoint pen. The tip of this probe vibrates by 1/1000 of an inch and exudes ultrasonic energy at 40,000 cycles per second. This ultrasonic vibration pulverizes the cataract into fine particles, which can then be aspirated out through another opening in the probe and removed from the eye. The capsule sac is then filled with a sterile balanced salt solution and an artificial lens appropriate to the patient's eye.

The smaller incision has several benefits. First, the healing time is greatly reduced; patients can resume routine daily activities immediately following surgery. Second, there is a greatly reduced risk of complications such as retinal detachment, post-operative glare or infection. Third, the benefit of a more clear, crisp and brighter vision is an undeniable outcome of overall surgical procedure.

How Much Time Is Needed After Your Eye Surgery?

The first day following surgery, vision is usually blurry and highly changing. Often, it takes several days or weeks to become perfectly clear. During this healing period, you will be seen several times by your eye care professional so as to confirm normal recovery. In the first week, it is normal for the eye to be red, to feel scratchy, to water and to have a little discharge or crusting

particularly when you awaken. It is also common to notice little specks or "floaters" as they're called, in your vision. These symptoms will subside as time goes on.

The single most important point to remember is:
Do not bump or rub the eye.

Most normal activities can be resumed immediately. These include bathing, walking, reading and watching television. Swimming or heavy exercise should be resumed only after several weeks pass following surgery.

Two symptoms indicate a serious complication and require the immediate attention of your doctor:

1) Severe and persistent pain in the eye (not merely a mild scratchiness), and
2) A marked, sudden loss of vision.

Common Misunderstandings about Cataract Surgery

There is a common misconception that cataract removal requires the use of lasers. As you can see from the previous section, this is not true. A YAG laser, however, is often used months or years later following cataract surgery for a second, non-surgical treatment. Although the primary cataract cannot re-occur, the support capsule (the skin of the grape) around the artificial lens implant can cloud up and adversely affect vision; this is called a secondary cataract. The likelihood of this occurring relates somewhat to the type of cataract that was originally present; on average, it happens to about 30% of the patients. When these symptoms become significant, the ophthalmologist uses the YAG laser to make a small, permanent viewing hole in the cloudy support capsule. The procedure is performed in an office, with local anesthetic drops in the eye. There are no specific restrictions on activity afterwards.

When should a cataract be treated?

Even when your eye care professional detects a cataract in your eye, he/she may not recommend cataract surgery for several years. This is a highly

subjective decision, based on the patient's perception of his/her visual quality and your doctor's examination of your eye. By having your vision tested regularly, you and your eye care professional can discuss if and when you might need treatment.

III. LENS IMPLANTS (also see Chapter 2 Cataracts)

The most natural way of replacing the lens of the eye after it has developed a cataract is with an intraocular lens, also known as a lens implant; this provides the sharpest vision of all methods. Modern implants are made of a flexible plastic material like silicone or acrylic and are placed in the exact position that the cataract originally occupied. The flexibility of the lenses allows them to be folded and put into the eye through incisions that are only a few millimeters wide, kind of like a 'ship in a bottle'. These lenses are a tremendous advancement over earlier lenses which were made of a rigid plastic called PMMA (polymethylmethacrylate). These lenses required an incision at least as large as the implant, since the lens was not flexible. A cataract incision of this size required stitches to obtain a water-tight seal. Sutures are not usually required with modern cataract surgery due to the small size of the incision and its self-sealing design.

The lens implant continues to exist permanently in the eye; no maintenance is involved. The lens material is inert and therefore very easily accepted by the human body. This type of implant is also called a posterior chamber lens implant, because it is positioned behind the iris. Other types of implants are called anterior chamber lens implants because they are surgically implanted in front of the iris, in the anterior chamber of the eye. Millions of posterior chamber intraocular lenses have been implanted today because their use has become the standard in cataract surgery.

Intraocular lenses come in a range of powers and the selection of lens power is based on each individual eye. Prior to surgery, measurements will be taken in the office, that record the length of the eye and the curvature of the cornea.

The most precise way of measuring the length of the eye is through the use of light, rather than the older ultrasound-based techniques, and the instrument that is used for this purpose is the IOL Master. It also measures the curvature of the cornea. Both measurements (length and curvature) are then entered into a computer, which calculates the implant power.

Unlike the lenses we were born with, most implants cannot focus at all distances. In fact they are called monofocal lenses; meaning they focus at only one distance. So patients must make a choice to either get a lens that allows them to focus for reading **OR** at a far distance. If a patient is corrected for distance, reading glasses or even bifocals will be needed to read. If a patient chooses a lens to give better reading vision, they will need glasses when they need to see objects far away.

A newer style of lens called a multifocal implant works similar to a pair of bifocal glasses. When implanted into the eye it allows light rays from both near and distant objects to focus on the retina. This can allow a patient to read up close and see distant objects better without glasses than they ever could before with a monofocal lens. Patients interested in these newer multifocal implants need to be screened for certain eye diseases that might make them poor candidates. Some patients who have had these lenses implanted have noticed halos around lights under certain conditions because of how these lenses work.

Astigmatism is an abnormality of the shape of the cornea of the eye. If the cornea was perfectly round, like a soccer ball cut in half, there would be no astigmatism. Most corneas are shaped more like a spoon with a flat axis and a steep axis ninety degrees away from each other. Astigmatism is part of a persons' prescription and causes their vision to be blurry when it is uncorrected. Astigmatism may be corrected by either glasses, contacts, or even LASIK. Recently a lens implant has been approved to correct astigmatism at the time of cataract surgery. This leads to better vision without glasses after surgery. Correcting astigmatism with an implant is a very reliable and effective method for patients with moderate astigmatism. Another alternative for reducing astigmatism is the placement of special incisions in the cornea at the

time of cataract surgery called limbal relaxing incisions or LRIs. LRIs tend to decrease, but not totally eliminate astigmatism.

IV. CONJUNCTIVITIS (PINK EYE)

It is also known as Pink eye because of the inflamed tissues that are seen when the eyelid is pulled back. Conjunctivitis is the most common infectious disease of the eye that affects children.

There are (3) types of Conjunctivitis, caused either by bacteria, viruses or allergies. With the exception of the allergic type, conjunctivitis is typically contagious. However, it usually causes no danger to the eye or to your child's vision.

There are several signs and symptoms; these are tabulated below. The first symptom of conjunctivitis is discomfort in the eye, followed by redness and inflammation of the conjunctiva, the tissue covering the white part of the eye and inner surface of the eyelids. There is some pain associated with conjunctivitis, but your child will probably complain mostly of discomfort that is not relieved by rubbing or the sensation of something that feels like sand in the eye.

After a day or so of these symptoms, a white, yellow, or green discharge from the eyes may be present. In bacterial conjunctivitis, the discharge will be somewhat thick. In viral conjunctivitis, the discharge may be thinner, and may even be clear.

A. Viral conjunctivitis

- Watery discharge
- Irritation
- Red eye
- Infection usually begins with one eye, but may spread easily to the fellow eye

B. Allergic conjunctivitis

- Usually affects both eyes
- Itching
- Tearing
- Swollen eyelids

C. Bacterial conjunctivitis

- Stringy discharge that may cause the lids to stick together, expecially after sleeping,
- Swelling of the conjunctiva,
- Redness,
- Tearing,
- Irritation and/or a gritty feeling
- Usually affects only one eye, but may spread easily to the fellow eye

Many of the infections that cause conjunctivitis are highly contagious. Your child should wash his/her hands after touching his eyes to help prevent spread of the infection. Also, your child should not touch the infected eye and then touch the other eye without washing his hands. You should be sure to wash your own hands very thoroughly after touching your child's eyes, and items like towels, gauze, or cotton balls should be thrown away or laundered in hot water to avoid contamination.

Medical treatment for bacterial infectious conjunctivitis consists of prescription antibiotic drops or ointment for most cases. The antibiotic drops are usually used for children and ointment is suggested for babies. The course of treatment is about 1 week and drops are given about four times a day. The ointment treatment is given about two to three times daily, and can temporarily blur vision.

Viral infections are sometimes treatable with medication, depending on the virus involved.

V. DETACHED RETINA

What is retinal detachment?

The retina is the light-sensitive layer of tissue that lines the inside of the eye and sends visual messages through the optic nerve to the brain. When the retina detaches, it is lifted or pulled from its normal position. If not promptly treated**, retinal detachment can cause permanent vision loss**. In some cases, there may be small areas of the retina that are torn. These areas, called retinal tears or retinal breaks, can lead to retinal detachment by allowing fluid from the vitreous humor to pass through the tears or breaks thereby elevating the retina from the back wall of the eye. There are two types of treatment which effectively seal holes and tears and are referred to as:

1. laser surgery, and
2. cryopexy.

These will be discussed in detail below. Both methods are performed on an outpatient basis, and are not considered surgery.

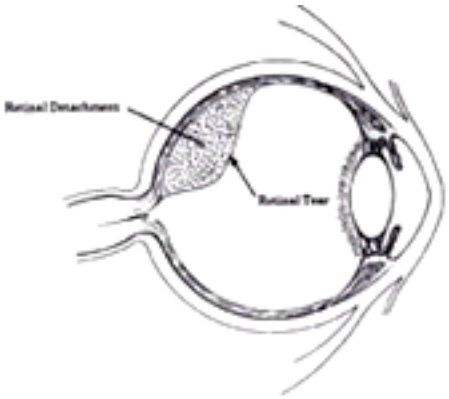


Figure 2. Retinal detachment. When a hole or tear develops in the retina, fluid can enter the hole, causing the retina to detach from the back wall of the eye.

What are the symptoms of retinal detachment?

Symptoms include a sudden or gradual increase in the number of floaters and/or light flashes in the eye or the appearance of a curtain over the field of vision. "Floaters" are loosened clumps or strands of cells within the vitreous humor (see Figure 1). Remember, the vitreous humor is a firm and jelly-like sac early in life. You can "see" the clumps or floaters because they cast a shadow on the retina. **A retinal detachment is a medical emergency**. Anyone experiencing the symptoms of a retinal detachment should see an eye care professional immediately.

What are the different types of retinal detachment?

There are three different types of retinal detachment:

1. **Rhegmatogenous** [reg-ma-TAH-jenous] -- A tear or break in the retina causes it to separate from the retinal pigment epithelium (RPE), the pigmented cell layer that nourishes the retina, and fill with fluid. These types of retinal detachments are the most common.
2. **Tractional** -- In this type of detachment, scar tissue on the retina's surface contracts and causes it to separate from the RPE. This type of detachment is less common.
3. **Exudative** -- Frequently caused by retinal diseases, including inflammatory disorders and injury/trauma to the eye. In this type, fluid leaks into the area underneath the retina (subretina).

Who is at risk for retinal detachment?

Although anyone can experience a retinal detachment, people with certain eye conditions are at increased risk. Some examples of these conditions include posterior vitreous detachment, lattice degeneration, x-linked retinoschisis, degenerative myopia, and uveitis. Injuries to the eye or head can also cause retinal detachment.

How is retinal detachment treated?

Small holes and tears are treated either with laser surgery or a freeze treatment called cryopexy. During laser surgery, tiny burns are made around the hole to

"weld" the retina back to into place. This is the most common form of treatment today. Cryopexy is a similar procedure that freezes the area around the hole. It is often used if the tear is located near the front of the eye, where the peripheral retina ends. In either treatment, the ophthamologist directly visualizes the retinal tear to ensure proper placement of either the freezing probe, in the case of cryopexy, or the laser burns, in the case of laser surgery. Within several days of treatment, a scar forms which permanently seals off the retinal tear and prevents it from leading to a retinal detachment.

Retinal detachments will occur following some, but not all retinal tears if they are not treated. Retinal detachments are treated with surgery that may require the patient to stay in the hospital. In some cases a scleral buckle, a tiny synthetic band, is attached to the outside of the eyeball to gently push the wall of the eye against the detached retina. If necessary, a vitrectomy may also be performed to treat more severe cases. During a vitrectomy, the doctor makes a tiny incision in the sclera (white part of the eye). Next, a small instrument is placed into the eye to remove the vitreous. Salt solution is then injected into the eye to replace the vitreous. Early treatment can usually improve the vision of most patients with retinal detachment. Some patients, however, will need more than one procedure to repair the damage.

VI. DIABETIC RETINOPATHY

What is diabetic eye disease?

Diabetic eye disease refers to a group of eye problems that people with diabetes may face as a complication of this disease. All can cause severe vision loss or even blindness. Diabetic eye disease may include:

- **Diabetic retinopathy**--damage to the blood vessels in the retina.
- **Cataract**--clouding of the eye's lens.
- **Glaucoma**--increase in fluid pressure inside the eye that leads to optic nerve damage and loss of vision.

Cataract and glaucoma also affect many people who do not have diabetes.

What is the most common diabetic eye disease?

Diabetic retinopathy. This disease is a leading cause of blindness in American adults. Diabetes affects between 10-12 million individuals in the US alone. One quarter of all those with diabetes will have some form of diabetic retinopathy. It is caused by changes in the blood vessels of the retina. In some people with diabetic retinopathy, retinal blood vessels may swell and leak fluid. In other people, abnormal new blood vessels grow on the surface of the retina. These changes may result in vision loss or blindness.

Who is most likely to get diabetic retinopathy?

Anyone with diabetes is at potential risk for diabetic retinopathy. The longer someone has diabetes, the more likely he or she will get diabetic retinopathy, including the more severe proliferative form.

What are its symptoms?

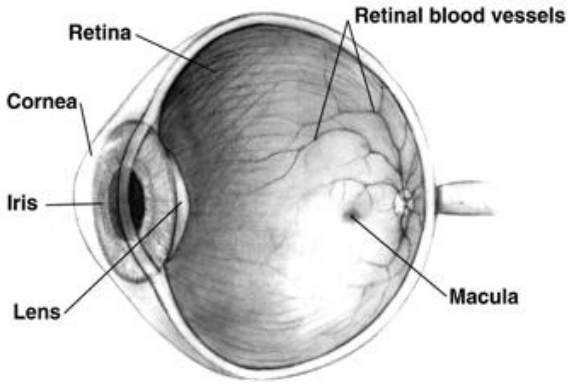
Often there are no symptoms in the early stages of the disease. Vision may not change until the disease becomes severe. There may not be any signs of pain. Blurred vision may occur when the macula--the part of the retina that provides sharp, straight ahead vision--swells from leaking fluid. This condition is called macular edema. It comes about when in **background retinopathy**, a general weakening of the walls of blood vessels takes place leading to a reduced capillary blood supply. Further, when these vessels leak, it leads to macular edema. This form of diabetic retinopathy is the most frequent cause of vision loss in diabetics.

Proliferative retinopathy is the more severe form. It is often accompanied by the growth of new blood vessels on the surface of the retina, which subsequently bleed into the eye, blocking vision. Even in more advanced cases, the disease may progress a long way without symptoms, when for

instance the abnormal blood vessels are outside of the macular zone. That is why regular eye examinations for people with diabetes are so important.

How is it detected?

If you have diabetes, you should have your eyes examined at least once a year. Your eyes should be dilated during the exam. Fluorescein angiography can easily demonstrate the leakage from abnormal blood vessels along with other



features of diabetic retinopathy. In this test, a special dye is injected into your arm. Pictures are then taken as the dye passes through the blood vessels in the retina. This test allows your doctor to find the leaking blood vessels.

Figure 3. Retinal blood vessels during fluorescein angiography.

Can diabetic retinopathy be treated?

Yes. Laser surgery, in which a laser beam is aimed onto the retina to shrink the abnormal blood vessels, is often used. This form of laser treatment is called panretinal photocoagulation. Treatment of each eye may be divided into 2-4 sessions, spaced over a period of weeks. Laser surgery has been proved to reduce the risk of severe vision loss from advanced or **proliferative** diabetic retinopathy by 60 percent.

It must be kept in mind that in some cases, positive visual gain may not be immediately apparent. Additional laser treatments may be required in the

future, even following a full initial course of panretinal photocoagulation. When, for instance, blood is found in the vitreous humor, laser treatment may not be possible. In such highly advanced cases, a technique in which small freezes are applied to the peripheral retina, may be performed. In yet more advanced cases of proliferative diabetic retinopathy, surgery may be required to remove vitreous hemorrhage, or to repair a traction detachment of the retina.

If you have a milder form of diabetic retinopathy involving macular edema, laser surgery will also likely be used. In this case, the laser beam is used to seal the leaking blood vessels. However, laser surgery often cannot restore vision that has already been lost. That is why finding diabetic retinopathy early is the best way to prevent vision loss.

Can diabetic retinopathy be prevented?

Not totally, but your risk can be greatly reduced. The Diabetes Control and Complications Trial (DCCT) showed that better control of blood sugar level slows the onset and progression of retinopathy and lessens the need for laser surgery for severe retinopathy. The study found that the group that tried to keep their blood sugar levels as close to normal as possible had much less eye, kidney, and nerve disease. This level of blood sugar control may not be best for everyone, including some elderly patients, children under 13, or people with heart disease. So ask your doctor if this program is right for you.

How common are the other diabetic eye diseases?

If you have diabetes, you are also at risk for other diabetic eye diseases. Studies show that you are twice as likely to get a cataract as a person who does not have the disease. Also, cataracts develop at an earlier age in people with diabetes. Cataracts can usually be treated by surgery.
Glaucoma may also become a problem. A person with diabetes is nearly twice as likely to get glaucoma as other adults. And, as with diabetic retinopathy, the longer you have had diabetes, the greater your risk of getting glaucoma. Glaucoma may be treated with medications, laser, or other forms of surgery.

How is it treated?

There are two treatments for diabetic retinopathy, **laser surgery** and **vitrectomy**. It is important to note that although these treatments are very successful, they do not "cure" diabetic retinopathy. They are very effective in reducing vision loss from this disease. In fact, even people with advanced retinopathy have a 90 percent chance of keeping their vision when they get treatment before the retina is severely damaged.

Laser Surgery

Laser surgery is performed in a doctor's office or eye clinic. Before the surgery, your ophthalmologist will: (1) dilate your pupil and (2) apply drops to numb the eye. In some cases, the doctor also may numb the area behind the eye to prevent any discomfort.

The lights in the office will be dim. As you sit facing the laser machine, your ophthalmologist will hold a special lens to your eye. During the procedure, you may see flashes of light. These flashes may eventually create a stinging sensation that makes you feel a little uncomfortable. You may leave the office once the treatment is done, but you will need someone to drive you home. Because your pupils will remain dilated for a few hours, you also should bring a pair of sunglasses.

Doctors will perform laser surgery to treat **macular edema** and **proliferative retinopathy**.

> ***Macular Edema:*** Timely laser surgery can reduce vision loss from macular edema by half. But you may need to have laser surgery more than once to control the leaking fluid. During the surgery, your ophthalmologist will aim a laser beam directly onto the damaged blood vessels. This is called **focal laser treatment**. This seals the vessels and stops them from leaking. Generally, laser surgery is used to stabilize vision, not necessarily to improve it.

Proliferative Retinopathy: In treating advanced diabetic retinopathy, doctors use the laser to destroy the abnormal blood vessels that form at the back of the eye. Rather than focussing the light on a single spot, hundreds of small laser burns away from the center of the retina are created. This is called **scatter laser treatment**. The treatment shrinks the abnormal blood vessels. You will lose some of your side vision after this surgery to save the rest of your sight. Laser surgery may also slightly reduce your color and night vision. Once you have proliferative retinopathy, you will always be at risk for new bleeding. This means you may need treatment more than once to preserve your sight.

Vitrectomy

Instead of laser surgery, you may need an eye operation called a **vitrectomy** to restore your sight. A vitrectomy is performed if you have a lot of blood in the vitreous. It involves removing the cloudy vitreous and replacing it with a salt solution. Because the vitreous is mostly water, you will notice no change between the salt solution and the normal vitreous. Studies show that people who have a vitrectomy soon after a large hemorrhage are more likely to recover their vision than someone who waits to have the operation. Early vitrectomy is especially effective in people with insulin-dependent diabetes, who may be at greater risk of blindness from a hemorrhage into the eye.

Vitrectomy is often done under local anesthesia. This means that you will be awake during the operation. The doctor makes a tiny incision in the sclera, or white of the eye. Next, a small instrument is placed into the eye. It removes the vitreous and inserts the salt solution into the eye. You may be able to return home soon after the vitrectomy. Your eye will be red and sensitive. After the operation, you will need to wear an eyepatch for a few days or weeks to protect the eye. You will also need to use medicated eye drops to protect against infection.

What can you do to protect your vision?

Studies have found that better control of blood sugar levels slows the onset and progression of retinopathy and lessens the need for laser surgery for severe retinopathy.

VII. DRY EYE

Dry eye syndrome is the decline of the quality or quantity of tears bathing the eye. The patient experiences constant pain from eye irritation, and a sandy or gritty sensation that, if untreated, can lead to scarring or ulceration of the cornea, and thus loss of vision.

Over ten million Americans suffer from dry eyes. In many cases, dry eye results from disorders of the various glands which work together to produce normal tears. Tears themselves are a complex combination of substances which form three layers on the eye: 1) an outer oily layer, 2) a middle, primarily watery layer, and 3) an inner sticky mucous layer. With each blink, the eyelids spread the tears over the eye. Excess tears flow into two tiny drainage ducts in the corner of the eye by the nose. These ducts lead to tiny canals that connect to the nasal passage. The connection between the tear ducts and the nasal passage is the reason that crying causes a runny nose.

In the dry eye syndrome, there is a shortage of one or more of these layers which prevents adequate lubrication and wetting of the cornea. One quite common reason for dryness is simply the normal aging process. As we grow older, our bodies produce less oil – 60% less at age 65 than at age 18. This is more pronounced in women, who tend to have drier skin then men. The oil deficiency affects the tear film. Without as much oil to seal the watery layer, the tear film evaporates much faster, leaving dry areas on the cornea.

Contact lens wearers may also suffer from dryness because the contacts absorb the tear film, causing proteins to form on the surface of the lens. Certain

medications, thyroid conditions, vitamin A deficiency, and diseases such as Parkinson's and Sjogren's can also cause dryness. Women frequently experience problems with dry eyes as they enter menopause because of hormonal changes.

There are several methods to test for dry eyes. The doctor will first determine the underlying cause by measuring the production, evaporation rate and quality of the tear film. Special drops that highlight problems that would be otherwise invisible are particularly helpful to diagnose the presence and extent of the dryness.

Treatment

When it comes to treating dry eyes, everyone's needs are a little different. If, as stated above, the dry eye syndrome is caused by a reduction of one or two of the normal components of the tear film, then the condition is treated by supplementing the natural tears with artificial tears, in an attempt to relieve the symptoms. There are many different brands of eye drops that are available without prescription from your pharmacy. Some examples are:

1) Hypotears

2) Prefin Liquifilm tears

3) Tears Naturale II

4) Refresh

Unlike the drops that are used to make the eye white when it is inflamed and red, these are lubricating drops. They are widely used, particularly by people over the age of 45 and can be used as frequently as needed to keep the eyes comfortable.

The treatment of dry eyes with drops alone is frequently adequate. When the condition is more advanced, a lubricating ointment can be instilled at night prior to going to bed. Some examples of these ointments are:

1) Refresh PM Ointment

2) Hypotears Ointment

3) Lacrilube Ointment

Patients with dry eye syndrome frequently "tear" a great deal. It is difficult for them to understand why it is necessary to add artificial tears to the eye, when in fact, they are producing too many tears. The problem is that the watery tears produced do not have the proper chemical constitution. Often times, there is a lack of the sticky mucous component to the tears. In that case, the tear film evaporates more easily, and dry spots develop on the cornea. These dry spots, or any irritations to the eye, prompt the lacrimal (tear) gland to secrete excessive amounts of the watery component of tears. However, without the mucous component, these natural thin watery tears are not viscous enough to truly lubricate the eye, and simply run off. Artificial tears contain ingredients mimicking all three tear components; therefore, they provide a more stable, evaporation-resistant, lubricating layer.

In more advanced cases of the dry eye syndrome, where there is potential damage to the cornea, referred to as kerato-conjunctivitis sicca, bandage soft contact lenses have been applied. For some cases, the openings of the tear ducts, which drain the tears, can be closed with special inserts called punctal plugs. This works like closing a sink drain with a stopper. These special plugs trap the tears on the eye, keeping it moist. This may be done on a temporary basis with a dissolvable collagen plug, or permanently with a silicone plug.

There are also simple lifestyle changes that can significantly improve irritation from dry eyes. For example, drinking eight to ten glasses of water each day keeps the body hydrated and flushes impurities. Make a conscious effort to blink frequently – especially when reading or watching television. Avoid rubbing the eyes. This only worsens the irritation.

Treating dry eye problems is important not only for comfort, but also for the health of the cornea.

VIII. Glaucoma

What is glaucoma?

Glaucoma is an eye disease in which the normal fluid pressure inside the eyes slowly rises, which in turn can lead to damage of the delicate nerve fibers in the retina, that then lead to vision loss, or even blindness. This chapter is predominantly about open-angle glaucoma, the most common form of the disease. The last section covers a more uncommon form, known as acute angle closure glaucoma.

What causes it?

At the front of the eye, there is a small space called the anterior chamber, which contains the aqueous humor (see Figure 1). Clear fluid flows in and out of the chamber to bathe and nourish nearby tissues. In glaucoma, for still unknown reasons, the fluid drains too slowly out of the eye. As the fluid builds up, the pressure inside the eye rises. Unless this pressure is controlled, it may cause damage to the optic nerve and other parts of the eye, resulting in a net loss of vision.

Who is most likely to get it?

Nearly 3 million people have glaucoma, a leading cause of blindness in the United States. Although anyone can get glaucoma, some people are at higher risk. They include:

- African Americans over age 40.
- Everyone over age 60.
- People with a family history of glaucoma.

Relative to Caucasians and other population groups, African- Americans:

- Have up to 6 times the risk for developing glaucoma;
- Are at higher risk for developing more severe disease with greater initial visual field loss at an earlier age;

- Are 8-fold more likely to become blind due to glaucoma.

Other risk factors, which must be taken into consideration, would be a history of high blood pressure, diabetes, ocular trauma or inflammation.

What are the symptoms?

At first, there are no symptoms. Glaucoma is often referred to as the thief in the night, mainly because it occurs without symptoms until very late in the disease process. Glaucoma causes damage to the optic nerve, which causes reduction in side vision. This is a very slow process, which causes no pain or irritation. The very early visual reduction that it does cause starts in the far periphery, which often goes unnoticed. This gradually consolidates and marches its way inwards, until very late in the disease, it takes ones central vision.

The 3 signs of open-angle Glaucoma, detectable through examination by an eye care professional, are:

1) Increased fluid pressure in the eye,
2) Visible damage to the optic nerve head, and
3) Loss of some degree of peripheral vision, which is determined from a visual field test.

Because the peripheral or side vision is often lost gradually over many months or years, patients usually do not notice the gradual constriction of their peripheral vision. This is especially true if, as is frequently the case, elderly patients are simultaneously developing cataracts. Only in the very advanced stages will patients become aware that something is wrong with their vision.

How is it detected?

There are various methods for determining the fluid pressure in the eye. One common method is known as the applanation tonometry. However, glaucoma generally cannot be diagnosed by one test alone. It is the interpretation of results of several tests including tonometry, visual field testing, and optic nerve

head analysis that allows the eye doctor to make a diagnosis of glaucoma. The optic nerve head test and visual field analyzer test are both described below.

Examination of the Optic Nerve Head

The optic nerve head is a visible, circular area where the optic nerve joins the back of the eye. It has an outer rim and a small pale depression in the center called the "cup". In normal patients who do not have glaucoma, the size of the cup is usually less than one-third the overall size of the optic nerve head. Your physician carefully inspects the cup and if it is abnormally enlarged, then that may be symptomatic of the nerve fibers undergoing damage from high pressure in the eye. During the inspection, the optic nerve head is also examined to verify presence of the usual number of small, fine blood vessels coursing over its surface and that it has the normal orange coloration.

The eye pressure may be elevated above the average range of 10 - 21 mm of Hg, or in some instances, it may be within the average normal range. In the latter situation, it is the careful inspection of the optic nerve that indicates whether a patient may be one of the few people that has glaucoma despite normal intraocular pressures, a condition referred to as "low tension" glaucoma.

Visual Field Test

The Visual Field Test is a method of accurately measuring the angular range and sensitivity of the peripheral vision of each eye. The patient's head is placed on a chin rest and the head is surrounded by a white bowl approximately 3 feet in diameter, which makes up the body of an instrument that is computer-controlled. The test is conducted in the dark, with the untested eye covered by a patch to reduce distractions.

The patient is first asked to stare at a small central fixation light in the back of the bowl, opposite of the chin rest. Once the patient’s gaze is fixed, small white lights will flash in random fashion on the inside of the bowl. The patient is asked to press a button each time he/she sees a light flash. The sequence of

flashing lights and the intensity of the lights are electronically controlled by sophisticated compute software. At the end of the procedure, the computer prints out a detailed map of the patient's peripheral vision for each eye, including any abnormal areas resulting from optic nerve damage. Since this test is automated and computerized, we can carefully monitor any change to the peripheral vision by repeating the test in the future. This method of determining visual fields is an important advance toward the early detection of Glaucoma.

How can it be treated?

A variety of options are available to treat glaucoma. These include eye drops, laser procedures, and surgery. All are intended to decrease eye pressure and, thereby, protect the optic nerve. Currently, in the US, eye drops are often the first choice for treating patients. For many people a combination of medications and laser treatment can safely control eye pressure for years.

Eye drops used in managing glaucoma decrease eye pressure by helping the eye's fluid to drain better and/or decreasing the amount of fluid made by the eye. Drugs to treat glaucoma are classified by their active ingredient. These include: prostaglandin analogs, beta blockers, alpha agonists, and carbonic anhydrase inhibitors. In addition, combination drugs are available for patients who require more than one type of medication.

Prostaglandin analogs include Xalatan®, Lumigan®, and Travatan Z®, and they work by increasing the outflow of fluid from the eye. They have few systemic side effects but are associated with changes to the eye itself, including change in iris color and growth of eyelashes (see "Side Effects" below). Depending on the individual, one of these brands may be more effective and produce fewer side effects.

Beta blockers such as timolol are the second most often used class of medication and work by decreasing production of fluid. They are available in generic form and, therefore, are relatively inexpensive. Moreover, systemic side effects can be minimized by closing the eyes following application or

using a technique called punctal occlusion that prevents the drug from entering the tear drainage duct and systemic circulation.

Alpha agonists (Alphagan®P, iopidine®) work to both decrease production of fluid and increase drainage. Alphagan P has a purite preservative that breaks down into natural tear components and may be more effective for people who have allergic reactions to preservatives in other eye drops. Alphagan is available in a generic form.

Carbonic anhydrase inhibitors (CAIs) reduce eye pressure by decreasing the production of intraocular fluid. These are available as eye drops (Trusopt®, Azopt™) as well as pills [Diamox® (acetazolamide) and Neptazane® (methazolamide)].

Combined medications can offer an alternative for patients who need more than one type of medication. In addition to the convenience of using one eyedrop bottle instead of two, there may also be a financial advantage, depending on your insurance plan. Cosopt® is a combination of a beta blocker (timolol) and a carbonic anhydrase inhibitor (Trusopt). Combigan™ is new and combines an alpha agonist (brimonidine) with a beta blocker (timolol).

Treatment Concerns

Of course, no eye drop medication can be effective if it is not taken as prescribed. There are a number of reasons why people being treated for glaucoma may not take their medications. One reason is that they simply forget! Remembering to take a daily medication is one of the challenges in the treatment of any chronic condition, and glaucoma is no exception. Some ways to help remember include tying a regular daily activity (such as brushing one's teeth) to taking one's medication, or setting timed reminders such as an alarm clock or cell phone. A second factor in not taking medication as prescribed is economics. Glaucoma drugs can be expensive. Your doctor can help you find financial assistance if you need it; some pharmaceutical companies offer programs to patients who can't afford the drugs they need. Also, some medications may be covered by your insurance while others are not. Your eye doctor will work with you to recommend the best choice for you.

For patients who cannot tolerate medications or for whom medication alone has not been adequate, laser treatment continues to be an excellent alternative. It should be noted that laser may also be used as primary treatment. The advantage of this approach is that if adequate pressure lowering is achieved with laser treatment alone, the need for taking a daily medication may be delayed, along with the associated side effects. The effect of laser treatment is typically not permanent, and many patients will eventually require medications. The most common laser treatments for glaucoma are argon laser trabeculoplasty (ALT) and selective laser trabeculoplasty (SLT). A new type of laser treatment called MicroPulse laser trabeculoplasy (MLT) is currently being studied as yet another option for effectively increasing drainage of eye fluid to lower pressure. During laser surgery, a laser beam is focused on the part of the anterior chamber where the fluid leaves the eye. This results in a series of small changes, which makes it easier for fluid to exit the eye. Over time, the effect of laser surgery may wear off. Patients who have this form of surgery may not need to keep taking glaucoma drugs.

Side Effects

Potential side effects of the most commonly prescribed glaucoma medications.

- **Prostaglandin Analogs:** possible changes in eye color and eyelid skin, stinging, blurred vision, eye redness, itching, burning.
- **Beta Blockers:** low blood pressure, reduced pulse rate, fatigue, shortness of breath; rarely: reduced libido, depression.
- **Alpha Agonists:** burning or stinging, fatigue, headache, drowsiness, dry mouth and nose, relatively higher likelihood of allergic reaction.
- **Carbonic Anhydrase Inhibitors:** in eye drop form: stinging, burning, eye discomfort; in pill form: tingling hands and feet, stomach upset, memory problems, depression, frequent urination.

Side effects of combined medications may include any of the side effects of the drug types they contain.

Although open-angle glaucoma cannot be cured, it can usually be controlled.

For most people with glaucoma, regular use of medications will control the increased fluid pressure. In some cases, these drugs may stop working over time or they may cause side effects. If a problem occurs, your eye care professional may select other drugs, change the dose, or suggest other ways to deal with the problem.

Surgery

Surgery can also help fluid escape from the eye and thereby reduce the pressure. However, surgery is usually reserved for patients whose pressure cannot be controlled with eye drops, pills, or laser surgery.

This surgery is called a filtration procedure or trabeculectomy. The surgeon makes a hole in the sclera (the white of the eye) where it meets the cornea (the clear part). This hole acts like a release valve, allowing fluid from inside the eye to drain, or "filter", externally where it collects beneath the conjunctiva (the transparent membrane covering the sclera). From this location, the fluid can then be absorbed by the blood stream of the conjunctiva. The hole is positioned so that this entire area is comfortably conceived beneath the upper eyelid. If a cataract co-exists, it is possible to combine glaucoma filtering surgery with cataract and intraocular lens implant surgery.

Acute Angle Closure Glaucoma

There exists an unusual form of glaucoma. The symptoms are dramatic, with severe pain in one eye, a sudden haziness of vision accompanied with haloes around lights. The pain can be accompanied with nausea and/or vomiting.

This type of glaucoma is referred to as “narrow-angle” glaucoma. It occurs when the angle between the iris and the cornea in the eye is too small. This can cause the iris to, spontaneously, block the fluid drainage channel, which results in a highly elevated inner eye pressure. When this happens, it is called an acute attack of angle closure glaucoma. Because the severe rise in eye pressure can quickly lead to permanent optic nerve damage, **this type of glaucoma should be treated as an emergency**.

The first phase of treatment is to lower the pressure using medications that effectively pull the iris away from the outflow channel of the eye. Once this has been achieved, the ophthalmologist uses a procedure called Laser Peripheral Iridotomy (LPI). A laser is used to create a small hole in the iris, thus allowing the fluid a bypass route to the outflow channel. After the LPI

treatment is done, it is important to understand that patients are still at risk for developing “regular” glaucoma and should maintain regular visits to their eye professional to monitor for such development.

It is often the case that both eyes will need to have LPI treatment as a preventative measure. If an attack of angle closure glaucoma has not occurred, but the eyes are anatomically predisposed and therefore at high risk, preventative LPI treatment may also be performed. This unusual type of glaucoma is relatively more common in farsighted or hyperopic patients.

IX. LASIK

LASIK is an acronym for LASer In-situ Keratomileusis. Keratomileusis and is derived from the Greek word keratos, which means “cornea”, and mileusis, which means “carving” – literally carving of the cornea. A laser beam is used to sculpt the cornea into the desired shape. It is now a well-accepted procedure that changes the refractive power of the cornea so as to reduce, or in many cases, eliminate naturally-occurring myopia, hyperopia and astigmatism. It is estimated that 2 million LASIK procedures were performed in the US in the year 2001.

The idea behind LASIK is to modify the shape of the cornea so that light entering the eye is sharply focused onto the retina.

In near-sighted or myopic eyes, objects at a distance are out of focus when they reach the retina. There is a disproportion between the focusing elements of the eye (the cornea and the crystalline lens) and the total length of the eye. This is shown in Figure 4.

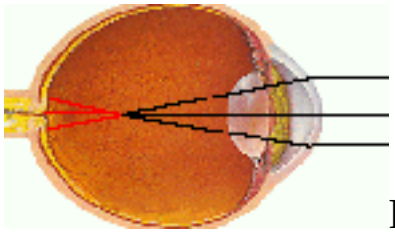


Figure 4. Myopic eyes.

In hyperopic or far-sighted eyes, objects that are nearby are out of focus on the retina. Either the cornea is too flat or the eyeball is too short in length, with the end result that objects come to a hypothetical focus behind the retina as shown in Figure 5.

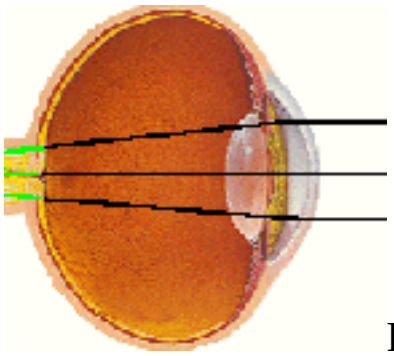


Figure 5. Hyperopic eyes.

In astigmatic eyes, the focussing elements of the eye (cornea and crystalline lens) are out of round so that all light rays do not come to focus at the same point. Those objects that are side-to-side come to focus at a different distance than those that objects that face top-to-bottom, as shown in Figure 6.

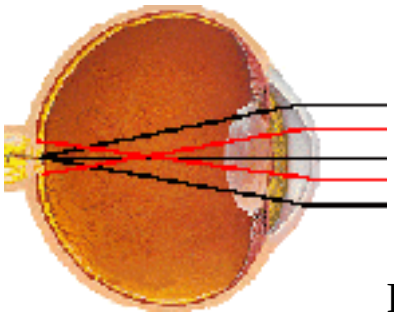


Figure 6. Astigmatic eyes.

Combinations of myopia and astigmatism or hyperopia and astigmatism are common. Glasses or contact lenses are designed to compensate for the eye's imperfections. LASIK surgery is aimed at reducing the need for visual aids like eye glasses. In LASIK surgery, precise and controlled removal of corneal tissue by an excimer laser reshapes the cornea thereby changing its focusing power.

The LASIK procedure involves the use of two highly sophisticated instruments: 1) the microkeratome, for use in surgically creating a thin flap in the center of the cornea, and 2) the excimer laser, for ablating or removing the corneal tissue that is exposed by creation of the flap, to the degree required to correct the refractive vision problem.

In addition to yielding high levels of success in correcting nearsightedness, farsightedness and astigmatism, LASIK has gained popularity with refractive vision doctors and patients alike by virtue of many additional advantages it offers: rapid vision recovery, little postoperative discomfort, and long-term refractive stability.

The Ideal LASIK Candidate

The ideal candidate includes those who:

- Are over 18 years of age and have had a stable glasses or contact lens prescription for at least two years.

- Have sufficient corneal thickness. A LASIK patient should have a cornea that is thick enough to allow the surgeon to safely create a clean corneal flap of appropriate depth.

- Are affected by one of the common types of vision problems or refractive error – myopia (nearsightedness), astigmatism, hyperopia (farsightedness), or a combination thereof (e.g., myopia with astigmatism).

- Do not suffer from any disease, vision-related or otherwise, that may reduce the effectiveness of the surgery or the patient's ability to heal properly and quickly.

- Are adequately informed about the benefits and risks of the procedure. Candidates should thoroughly discuss the procedure with their doctors and understand that for most people, the goal of refractive surgery should be the reduction of dependency on glasses and contact lenses, not their complete elimination.

The Non-LASIK Candidate

Certain conditions and circumstances completely preclude individuals from being candidates for LASIK surgery. Non-candidates include individuals who:

- Have diseases such as cataracts, advanced glaucoma, corneal diseases, corneal thinning disorders (keratoconus or pellucid marginal degeneration), or certain other pre-existing eye diseases that affect or threaten vision.

- Do not give informed consent. It is absolutely necessary that candidates adequately discuss the procedure and its benefits and risks with their surgeon, and provide the appropriate consent prior to undergoing the surgery.

- Have unrealistic expectations. It is critical for candidates to understand that laser eye surgery, as all surgical procedures, involves some risk. In addition, both the final outcome of surgery and the rate of healing vary from person to person and even from eye to eye in each individual.

The LASIK procedure in detail

Step One: Pre-operative measure

The LASIK procedure is performed on an outpatient basis. You should take comfort in knowing that the actual laser procedure often lasts less than a minute. However, you should plan to spend a couple of hours at the surgery center. Some of this time will be spent preparing you for the procedure, as detailed below.

Before the procedure begins, you may be given a surgical cap to keep your hair out of the way. Antibiotic and local anesthetic eye drops are then placed in your eye to numb it and prevent infection. With your eye closed, the skin around the eye is appropriately sterilized. Your eyelid will then be propped open with a lid retainer and mask is placed over the eye to keep your eyelashes out of the way. The final step before the procedure begins, is to mark your

cornea with a blue dye ring, which serves to provide a reference point for the surgeon. Since the cornea is numb, most patients experience little to no discomfort during these preoperative procedures.

Step Two: The Microkeratome

Next, the doctor mounts the microkeratome, held by suction, onto the center of the cornea. The microkeratome holds the cornea perfectly still while it's blade cuts the corneal flap, leaving a small section uncut to form a hinge. This precision instrument works like a miniature carpenter's plane and contains a disposable cutting blade that is preset according to the thickness of the patient's cornea. The flap thickness is typically 160-180 microns, or about a third the full depth of the average cornea. During the creation of the corneal flap, your sight will be diminished but you will experience no pain. The creation of the flap takes a short time, after which the surgeon removes the suction ring and microkeratome.

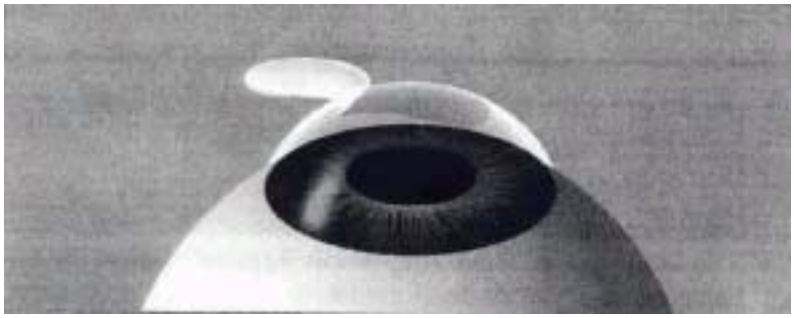


Figure 7. Cross-section of eye with a LASIK flap, folded back, prior to laser treatment.

After a flap of cornea is created with a microkeratome, the flap is gently lifted to expose the underlying corneal tissue that will be ablated by the excimer laser.

Step Three: The Laser

Your eye is now prepared for the next step of laser ablation. After the flap is folded back against its hinge, the doctor dries the underlying cornea and aligns the laser's microscope with the central cornea area in order to monitor the laser

ablation pulses. You will be asked to hold a steady gaze, directed at a red fixation light. As the doctor activates the laser, you will hear a popping or "tack tack tack" sound. There will also be a slight odor similar to that of hair burning. This is normal. The number of laser pulses will depend on the magnitude of the refractive error that is being corrected. After the laser phase of the procedure is over, which typically takes only a minute, the doctor folds the corneal flap back in place and irrigates the eye with saline solution. The corneal area may be dried, which serves to seal the flap. In addition, a non-prescription contact lens may be placed in the eye, for surface protection.

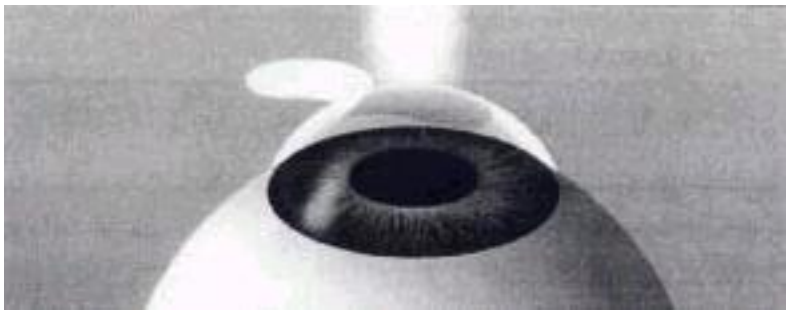


Figure 8. Cross-section of eye undergoing LASIK treatment.

Step Four: Post-operative Measures

After the procedure is complete, additional antibiotic drops are placed in your eye. When the anesthetic drops wear off after some time, you may experience some light sensitivity and a scratch or dry sensation as though you have something in your eye. This feeling usually passes after a few hours.

The following day, a postoperative examination is made at the doctor's office in order to confirm that the corneal flap is healing properly. If a contact lens was placed after surgery, it may be removed at this time. Your visual acuity will be checked and will most likely fall within the 20/20 to 20/40 range, without glasses. For many patients, vision continues to improve for several weeks after LASIK, before reaching final stable levels.

One Refractive Surgery Consideration: Monovision

Monovision is a 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 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. 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 surgery performed on your eyes. Find out if you pass your state's driver's license requirements with monovision.

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.

X. MACULAR DEGENERATION

What is age-related macular degeneration (AMD)?

AMD is a common eye disease associated with aging that gradually destroys sharp, central vision. Central vision is needed for seeing objects clearly and for common daily tasks such as reading and driving. In some people, AMD advances so slowly that it will have little effect on their vision as they age. But in others, the disease progresses faster and may lead to a loss of vision in one or both eyes.

How does AMD damage vision?

The retina is a paper-thin tissue that lines the back of the eye and sends visual signals to the brain. In the middle of the retina is a tiny area called the macula. The macula is made up of millions of light-sensing cells that help to produce central vision.

AMD occurs in two forms:

Dry AMD--Ninety percent of all people with AMD have this type. Scientists are still not sure what causes dry AMD. Studies suggest that an area of the retina becomes diseased, leading to the slow breakdown of the light-sensitive central vision.

Wet AMD--Although only 10 percent of all people with AMD have this type, it accounts for 90 percent of all blindness from the disease. As dry AMD worsens, new blood vessels may begin to grow and cause "wet" AMD. Because these new blood vessels tend to be very fragile, they will often leak blood and fluid under the macula. This causes rapid damage to the macula that can lead to the loss of central vision in a short period of time.

Who is most likely to get AMD?

The greatest risk factor is age. Although AMD may occur during middle age, studies show that people over age 60 are clearly at greater risk than other age groups. For instance, a large study found that people in middle-age have about a 2 percent risk of getting AMD, but this risk increased to nearly 30 percent in those over age 75.

Other AMD risk factors include:

- Gender--Women tend to be at greater risk for AMD than men.
- Race--Caucasians are much more likely to lose vision from AMD than African Americans.
- Smoking--Smoking may increase the risk of AMD.
- Family History--Those with immediate family members who have AMD are at a higher risk of developing the disease.

What are the symptoms?

Both dry and wet AMD cause no pain. The most common early sign of dry AMD is blurred vision. As fewer cells in the macula are able to function, people will see details less clearly in front of them, such as faces or words in a book. Often this blurred vision will go away in brighter light. If the loss of these light-sensing cells becomes great, people may see a small, but growing, blind spot in the middle of their field of vision. The classic early symptom of wet AMD is that straight lines appear crooked. This results when fluid from the leaking blood vessels gathers and lifts the macula, distorting vision. A small blind spot may also appear in wet AMD, resulting in loss of one's central vision.

How is it detected?

Your eye care professional may suspect AMD if you are over age 60 and have had recent changes in your central vision. To look for signs of the disease, he or she will use eye drops to dilate, or enlarge, your pupils. Dilating the pupils

allows your eye care professional to view the back of the eye better. You may also be asked to view an Amsler grid, a pattern that looks like a checkerboard. Early changes in your central vision will cause the grid to appear distorted, a sign of AMD.

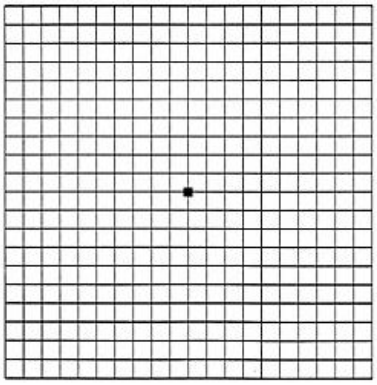


Figure 9. An Amsler grid.

While covering one eye, look at the dot in the center of the grid. If the lines around the dot are wavy or distorted, you should see your eye care professional.

How can it be treated?

In some individuals, taking a specific combination of vitamins has been found to slow the progress of dry AMD. One seminal study is known as the AREDS study. This combination of vitamins may be recommended by your eye doctor.

Ophthalmologists can treat many cases of wet AMD. Until recently, no effective treatments were known for wet macular degeneration. However, new drugs, called **anti-angiogenics** or anti-VEGF (anti-**Vascular Endothelial Growth Factor**) agents, can cause regression of the abnormal blood vessels and improvement of vision when injected directly into the vitreous humor of the eye. The injections have to be repeated on a monthly or bi-monthly basis. In certain situations, laser treatment can be utilized for wet AMD. This treatment involves aiming a laser beam onto the new blood vessels to destroy them. Laser surgery is done in a doctor's office or in an eye clinic and lasts a short period of time. Although a person may go home the same day, he or she

will need to return for follow-up exams. Additionally, another treatment, called photodynamic therapy (PDT), involves a light which activates a drug that is injected into your body to destroy leaking blood vessels.

What can you do to protect your vision?

Although there is no effective treatment for dry AMD at this time, it is crucial that those who progress to wet AMD and need treatment have it before the disease destroys central vision. For this reason, if you have dry AMD or are age 60 or older, you should have your eyes examined through dilated pupils at least once a year. You may also want to get an Amsler grid from your eye care professional to check your vision at home. Furthermore, lifestyle modifications can reduce your risk of developing the condition:

- Don't smoke
- Eat a healthy diet that is high in fruits with antioxidants and green, leafy vegetables; minimize animal fats
- Exercise regularly
- Maintain a healthy weight
- Control your blood pressure with the guidance of your primary care physician

XI. OCULAR HISTOPLASMOSIS SYNDROME (OHS) (Histoplasmosis may also be referred to as “Ohio River Valley Fever”)

What Is the Ocular Histoplasmosis Syndrome?

The fungus, found in chicken, bat and bird droppings, is inhaled early in life and causes a usually asymptomatic and self-limited infection throughout the body, including the lungs and choroid (the vascular layer lining the retina). For unknown reasons, several decades after the initial infection, the choroidal scars may develop abnormal blood vessels (choroidal neovascularization or **CNV**)

which leak fluid and blood. This leakage can only be seen in a careful, dilated eye examination since the eye looks normal from the outside. Distorted central vision and loss of reading vision occurs when the leakage involves the macula.

The goals of treatment are to prevent choroidal neovascularization (CNV) from spreading into the macula area, or limit the size of and leakage from the CNV once it reaches the macular center.

Who Gets the Ocular Histoplasmosis Syndrome?

People who live in endemic areas, such as the Ohio-Mississippi river basin, who are exposed to the histoplasmosis fungus early in life are at greatest risk for developing eye problems later in life. **A person with ocular histoplasmosis cannot infect other people** since the organisms die soon after the initial infection. Adults, who move to endemic areas, although they may get infected with the histoplasmosis fungus, do not usually develop eye disease.

What Are the Symptoms of the Ocular Histoplasmosis Syndrome?

People usually have no eye symptoms during the initial infection. The choroidal scar that may later form does not usually cause any symptoms. If leakage and bleeding involves the reading area of vision (the macula), symptoms such as distortion and loss of reading vision occur. Patients never go completely blind since the part of the eye responsible for peripheral vision is not affected by this disease.

Patients are often asked to check their central vision every day with an **Amsler Grid** [1]. While staring at the dot, you may notice that the straight lines in the pattern appear wavy to you. You may notice that some of the lines are missing. These may be signs of choroidal neovascularization.

How Do We Diagnose the Ocular Histoplasmosis Syndrome?

The most important step in accurately diagnosing the ocular histoplasmosis syndrome consists of a careful eye examination by an eye doctor familiar with all aspects of this disease. During the examination, your doctor will dilate your pupils and look for histoplasmosis scarring, leakage, and bleeding. Your doctor may need to perform an OCT scan and/or a fluorescein angiography to better

evaluate the histoplasmosis scars. Fluorescein angiography is a photographic test, not involving x-rays, in which a colored vegetable dye is injected into an arm vein which then travels through the blood vessels in the eye. A series of photographs are taken of the retina as the dye passes through the back of the eye. This allows your doctor to better diagnose the presence and extent of choroidal neovascularization to decide whether treatment can be offered.

What Treatments Are Available for Ocular Histoplasmosis?

1. Observation

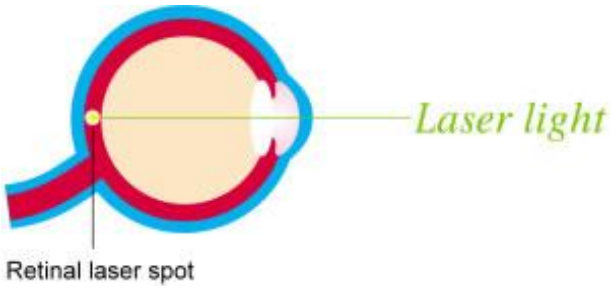
Patients with inactive histoplasmosis scarring and those who have been successfully treated are asked to look at the Amsler Grid daily for any central visual changes. If a change in the central vision or Amsler grid develops, the patient should seek prompt attention. A careful examination, OCT scans and fluorescein angiogram are needed to look for choroidal neovascularization that can possibly be treated.

2. Corticosteroids

Steroids are potent medicines that can reduce inflammation. Some doctors will occasionally recommend steroid pills or shots for the rare patient experiencing visual symptoms from acute histoplasmosis inflammation.

3. Laser Photocoagulation (“Hot” Laser)

Laser photocoagulation surgery is often used for patients with ocular histoplasmosis and choroidal neovascularization **outside the macular center**. When choroidal neovascularization is beneath the center of the macula (subfoveal), the laser not only destroys these abnormal vessels but also permanently damages the overlying retina.



Laser surgery is often effective in preventing severe visual loss in patients with choroidal neovascularization **not involving the part of the eye responsible for the very central reading vision**.

4. Visudyne Photodynamic Therapy ("Cold" Laser) [2]

Patients with choroidal neovascularization involving the central reading area of the eye are not treated with the "hot" laser at present since this treatment would destroy whatever central vision was left. Visudyne, also known as verteporfin for injection, is a light-activated, or photodynamic, drug that is injected into the bloodstream and travels to the abnormal vessels associated with CNV. It is then activated by a low-energy non-thermal laser, which produces a reaction that damages and closes abnormal vessels.

5. Endothelial Growth Factor (VEGF) Inhibitors

VEGF inhibitors (Macugen, Avastin, and Lucentis) are a new class of potent medications that prevent choroidal neovascularization from growing and leaking. They have been extensively studied in patients with age-related macular degeneration, and are also effective in ocular histoplasmosis.

What Are My Chances of Abnormal Blood Vessels Affecting My Good Eye?

Patients who have no signs of abnormal blood vessels in either eye have a minimal chance of losing central vision. This risk is increased, however, if abnormal blood vessels have already affected one eye. The yearly risk for the second eye becoming involved then increases to approximately 1 in 50.

What Can I Do to Prevent Visual Loss From Histoplasmosis?

There is nothing that a person with histoplasmosis can do to prevent abnormal vessels from developing. The most important thing is to carefully monitor the central vision with daily vision checks (including the Amsler Grid) and frequent, regular eye examinations. Any sudden change in the central vision necessitates an immediate examination by your eye doctor. Ocular histoplasmosis is a fairly common cause of central vision loss in the Ohio-Mississippi river basin. Patients are asymptomatic unless abnormal blood

vessels cause leakage and bleeding into the reading area of vision. Timely diagnosis and treatment are frequently successful in preventing loss of reading vision.

[1]See www.amslergrid.org

[2]See www.visudyne.com

XII. CORNEAL TRANSPLANT SURGERY

Who would need a corneal transplant?

Sometimes the transparent surface of the eye, the cornea, can become diseased or damaged. This can lead to a cloudy or opaque cornea which may severely decrease vision. The eye depends on a clear cornea to focus light onto the retina and form a clear image. Therefore, removing the cornea and replacing it can restore a clear surface to the eye. Conditions which can cloud the cornea include trauma (including previous eye surgery), hereditary conditions (such as Fuch's dystrophy), or severe/recurrent corneal infections.

How is the procedure performed?

There are now 2 main procedures to treat corneal diseases by transplantation:

1. **Full-Thickness Corneal Transplant (also known as penetrating keratoplasty or PK):** This is the classic tried-and-true form of replacing corneal tissue. The patient is prepared for surgery in a similar way to cataract or retinal surgery. A special instrument called a trephine measures and cuts the precise amount of the patient's cornea to replace. The patient's cornea is referred to as the "host" tissue. Then a similarly sized and shaped corneal "button" is removed from the eye of the "donor". This tissue is harvested from the eye of someone recently deceased and prepared and processed at an institution called an eye bank. The eye bank then ships the tissue overnight to the surgery center for the

transplant procedure. This "donor" tissue is then sutured into place on the patient's "host" cornea with 16-24 stitches.

Like any organ transplant, the risk of rejection always is present. Because of this, patients often need to take steroid eye drops for years, sometimes even indefinitely. There are other rare but serious risks of full-thickness corneal transplant which include infection, glaucoma, or even loss of the eye. It may take several months to over a year to regain good vision after corneal transplant surgery.

2. **DSEK (Descemet's Stripping Endothelial Keratoplasty):** Recent advances in instrument technology now allow corneal surgeons to replace certain layers of the cornea, rather than transplanting a full-thickness portion. This leads to a quicker, more comfortable surgical procedure with faster visual recovery. In addition, many of the risks associated with full-thickness corneal transplant are greatly reduced or even eliminated completely.

   Many (but not all) corneal diseases involve the inner-most layer of the cornea, called the endothelium. This endothelium makes a basement membrane, Descemet's membrane. Transplanting this layer of the cornea can treat the majority of diseases that cause corneal clouding. Instead of cutting a full-thickness section of the patient's cornea with a trephine, a much smaller incision similar to that employed in cataract surgery is used. Special instruments then enable the surgeon to strip and remove the patient's Descemet's membrane. This step provides a proper surface to attach the donor's endothelium. The donor cornea is divided into different layers at the eye bank, so the surgeon needs only to cut the proper size of tissue required and then separate the layers. The layer that contains the endothelium is then folded and inserted into the patient's eye. The donor tissue unfolds and an air bubble is injected into the eye to keep the endothelial graft pressed up against the patient's cornea. As the eye slowly absorbs the air bubble, the donor endothelium starts to pump out fluid from the host cornea, causing it to "stick" to the host. Sometimes the air bubble absorbs before the graft can completely adhere

to the host cornea. Then a new air bubble can be injected to re-attach the graft.

The risk of rejection for DSEK seems to be less than that for PK. Steroid drops are usually not needed for as long and vision usually recovers in a few weeks, compared to several months for full-thickness corneal transplant. Although DSEK is generally quicker, more comfortable, and safer than PK, it is not indicated for some conditions such as deep corneal scars from injury or infection. In these cases full-thickness corneal transplant is still the procedure of choice.

HARMEET CHAWLA, M.D.,
MEDICAL DIRECTOR,
CLINICAL OPHTHAMOLOGIST

Dr. Chawla received his undergraduate training at the George Washington University in Washington, D.C. There he was among the top in his class acquiring a GPA of 3.97 on a 4.0 scale. After completing only three years of college, he was accepted to Medical School one year early. At the Medical College of Virginia, Dr. Chawla earned his M.D. degree, ranking second in a class of 172. He then received his eye surgery training at the prestigious University of Illinois Eye and Ear Infirmary. Dr. Chawla travels to third world countries where he volunteers his surgical services. He is board certified by the American Board of Opthalmology and has been in private practice for over 10 years. Dr. Chawla has performed over 20,000 ophthalmic surgical procedures including cataract, glaucoma, eyelid, corneal transplant, laser vision correction and diabetic laser eye surgery. In a full one and a half page cover story, The Columbus Dispatch named Dr. Chawla the "Eye Surgeon for Eye Doctors" He dedicates a portion of his time teaching other eye care professionals the latest surgical and eye care techniques, along with providing continuing educational seminars for colleagues. Dr. Chawla enjoys travel and athletics and is a member of the American Academy of Ophthalmology and the American Society of Cataract and Refractive Surgery.

JAY EGOLF, M.D.,
CLINICAL OPHTHAMOLOGIST

Dr. Jay Egolf hails originally from southern New Jersey. He graduated cum laude from Rutgers University where he earned his Bachelor of Arts. He received his Medical Doctorate at Jefferson Medical College in Philadelphia before completing a medical internship with Christiana Care Health System in Delaware. The prestigious and historical Washington National Eye Center in Washington, DC was the site of his ophthalmologic specialty training. There the faculty unanimously voted him Chief Resident for his final year. Dr. Egolf was on duty during the 9/11/01 tragedy and treated Pentagon burn victims. Also during his residency, Dr. Egolf had the opportunity to study LASIK surgery under the same ophthalmologists who performed the procedure on some world- famous athletes. Besides cataract surgery and LASIK, Dr. Egolf has special interests in neuro-ophthalmology and glaucoma. He is a member of the American Medical Association, the American Academy of Ophthalmology, and the American Society of Cataract and Refractive Surgery. He is married to Dr. Jean Schoonover, an Internist in Portsmouth. In his spare time, he enjoys tennis, basketball, and playing the guitar.

PATRICK SCHUMACHER, M.D.,
CLINICAL OPHTHAMOLOGIST

Dr. Schumacher received his undergraduate degree from the Ohio State University where he graduated Summa Cum Laude with Honors in the liberal arts and was inducted into the honor societies of Phi Beta Kappa and Phi Kappa Phi. After college Dr. Schumacher earned his medical degree Cum Laude from the Ohio State University College of Medicine and Public Health. While there he was inducted into the premier medical honorary, Alpha Omega Alpha. For five years during both college and medical school, Dr. Schumacher performed with the Ohio State University Marching Band as a member of the snare drum line. He was on the field the last time the Buckeyes won the Rose Bowl and also represented the University at the Sugar Bowl and Citrus Bowl. After completion of his internship at Riverside Methodist Hospital in Columbus, Ohio, Dr. Schumacher finished his surgical training with the University of Kentucky Department of Ophthalmology where during his final year he was selected as Chief Resident and achieved a board score in the 99th percentile. Dr. Schumacher is Board Certified in Ophthalmology by the American Board of Medical Specialties and a member of the the American Academy of Ophthalmology, the American Society of Cataract and Refractive Surgery, and an EyeCare America volunteer who enjoys running, weightlifting, and soccer in his spare time.

ROGER ADLER, M.D.,
CLINICAL OPHTHAMOLOGIST

Dr. Roger T. Adler specializes in the treatment of diseases of the retina, macula and vitreous including diabetic retinopathy, macular degeneration, retinal detachment, and ocular inflammation. He received his medical degree from The Chicago Medical School in 1995. After accomplishing his internship in general surgery at Maimonides Medical Center in Brooklyn, New York, and his residency at Case Western Reserve University in Cleveland, Ohio, Dr. Adler completed a medical and surgical retina fellowship at The Eye Consultants of Atlanta, Georgia. Dr. Adler is a member of The American Society of Retina Specialists, The American Academy of Ophthalmologists, The American College of Eye Surgeons and The American Medical Association.

SAGAR PATEL, M.D.,
CLINICAL OPHTHAMOLOGIST

Dr. Patel was accepted to medical school directly from high school pending completion of his college studies. He received his undergraduate training at Youngstown State University, where he graduated summa cum laude through the Honor's College with a B.S. in Biological Sciences. He then went on to receive his Medical Doctorate from Northeast Ohio Universities College of Medicine, where he scored in the 97th percentile on his national board examination. Upon completion of medical school, Dr. Patel began internship at the Tulane University School of Medicine Program in New Orleans, LA. During his internship, Dr. Patel was one of few physicians who stayed in the city during Hurricane Katrina to assist the understaffed hospitals at the time. After successfully completing his internship, Dr. Patel completed residency training in ophthalmology at Tulane, followed by a fellowship in vitreoretinal diseases and surgery also at Tulane, under the training of Dr. James G. Diamond, MD. Dr. Patel is a member of the American Medical Association, and the American Academy of Ophthalmology.

TERRY SCHULTZ, O.D.

CENTER DIRECTOR,

CLINICAL OPTOMETRIST

Dr. Schultz received his undergraduate training at Ohio University and Ohio State University. After completing only 2 ½ years of college, he was accepted early to the Ohio State University College of Optometry. Dr. Schultz has over 20 years experience diagnosing and treating eye disease such as glaucoma, cataracts, conjunctivitis, foreign bodies, macular degeneration and diabetic eye conditions. As Center Director, Dr. Schultz is responsible for the day to day operation of the clinics and ambulatory surgery centers and is certified in excimer laser operation. Dr. Schultz enjoys golf, travel, spending time with his wife and two sons and is a member of the Ohio Optometric Association, American Optometric Association and American Society of Ophthalmic Administrators. Dr. Schultz has served as board President of the Fairfield Regional Vision Rehabilitation Center, President of Habitat for Humanity of Fairfield County, and board member for the Fairfield County Council for the Disabled.

STACIA WADDLE, O.D.

CLINICAL OPTOMETRIST

Dr. Waddle was born and raised in Washington Court House, Ohio. She graduated from The Ohio State University with a Bachelor of Science in Biology in 2002. During her undergraduate career she was inducted into the National Society of Collegiate Scholars and the honor societies of Alpha Lambda Delta and Phi Eta Sigma. Dr. Waddle received her Doctor of Optometry degree from The Ohio State University College of Optometry in 2006. During this time she held the position of secretary of her graduating class as well as secretary of the optometry student council. Dr. Waddle completed her disease externship with The Eye Specialists. During her spare time Dr. Waddle enjoys photography, travel, and spending quality time with her family and friends.

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