

TYSON EYE

RETINA INFORMATION

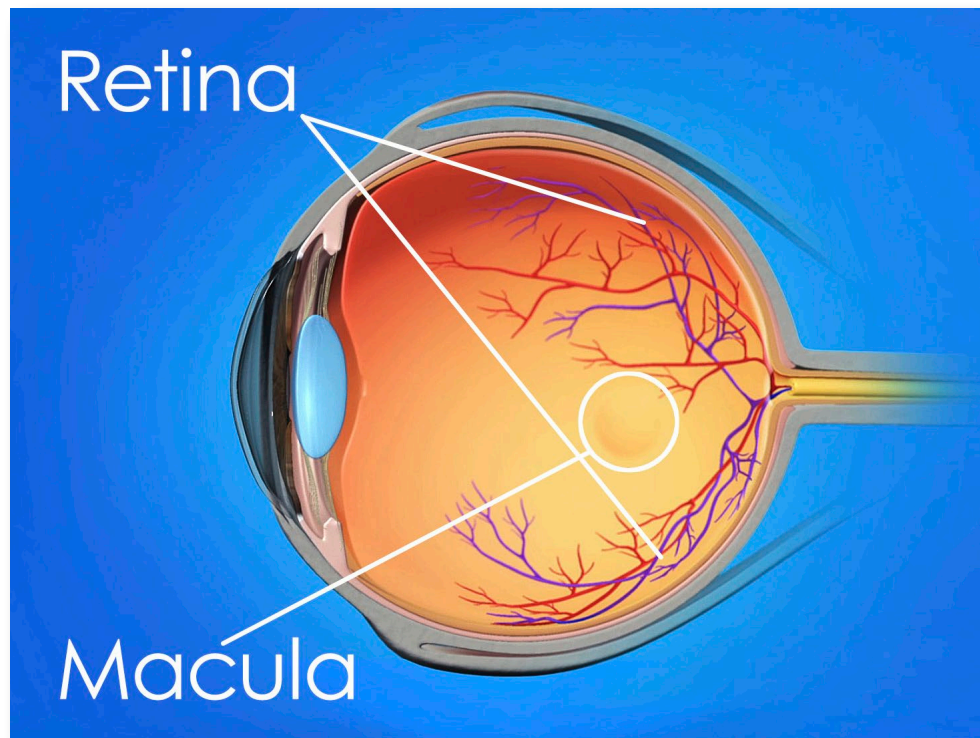
*Including Diabetic Retinopathy,
Macular Degeneration, and
Retinal Vein Occlusion*

What is the Retina?

The light sensitive interior lining of the eye is called the retina. Light entering the eye passes through the cornea, lens and vitreous before it focuses on the retina. The retina is a layered tissue that is comprised of a network of blood vessels and nerve cells. The bottom layer is the photoreceptor layer, which contains rods and cones to interpret the color and contrast in our vision. These cells convert the incoming light into electric signals which travel through the optic nerve to the brain for comprehension. Our central and detailed vision are processed by the macula which is the central portion of the retina.

If this tissue isn't healthy, we will not be able to see clearly regardless of glasses or other visual aids that may be used. Blood circulates through tiny vessels in the retina providing the nutrients needed to keep the retina healthy. Conditions that affect circulation and our blood, like diabetes and high blood pressure also affect the retina.

It's essential to keep your retina functioning properly to enjoy a lifetime of good eyesight. Many retina problems can be detected by your eye doctor before you notice any significant symptoms. When affected by a retina condition, early diagnosis and treatments are critical to retaining your current eyesight.



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Evaluation

Complete and comprehensive ophthalmic evaluation is important in the assessment of retinal conditions. On a visit to a retina specialist, you will receive vision testing, eye drops to dilate the pupils and a complete examination of the front and back of the eye. Pupillary dilation may create near vision blurring and therefore, it may be helpful to have a driver accompany the patient, although this is not always required.

Patients with retinal conditions may have several types of tests to assess the disease including:

Fluorescein Angiography - is a common, office-based diagnostic test that can help distinguish between non-proliferative and proliferative diabetic retinopathy. Fluorescein angiography is performed by injecting sodium fluorescein dye into a peripheral vein with a small needle. The dye then travels through the blood vessels and leaks through the abnormal blood vessels. After the test, patients will experience some transient yellowish skin discoloration and orange urine. Most patients tolerate the test well but a small percentage experience nausea and very rarely will have an allergic reaction.

Optical Coherence Tomography (OCT) - is a non-invasive, office-based imaging technique that uses a low energy laser to scan the macula and create a detailed map of the retinal architecture. OCT can help determine if there is fluid within or under the retina which may indicate diabetic macular edema. It is a commonly used test to monitor the response to treatment of diabetic macular edema and has no risk to the patient.

Color Photography - patients may undergo color photography of the retina to document hemorrhages and other characteristics of diabetic retinopathy.



If you would like more information about diabetes, please visit the American Diabetes Association at www.diabetes.org.

What is Diabetes?

Diabetes is a chronic health condition where the body is unable to produce enough insulin and properly break down sugar (glucose) in the blood. Symptoms include hunger, thirst, excessive urination, dehydration and weight loss. The treatment of diabetes may require daily insulin injections, proper nutrition and regular exercise. Insulin is a hormone that is needed to convert sugar, starches and other food into energy needed for daily life. Both genetics and environmental factors such as obesity and lack of exercise contribute to the cause of diabetes.

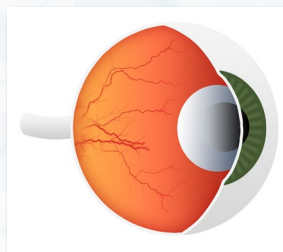
What are the Signs?

- **Excessive Thirst**
- **Frequent Urination**
- **Feeling Very Hungry or Tired**
- **Losing Weight Without Trying**
- **Poor Healing of Wounds**
- **Decreased Feeling or Tingling in Your Feet**
- **Blurry Vision**

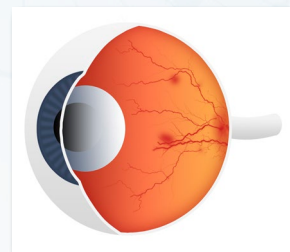
According to the American Academy of Ophthalmology, 95 percent of those with significant diabetic retinopathy can avoid substantial vision loss if they are treated in time.

Treatment for diabetic retinopathy depends on the stage of the disease and the specific problem that requires attention.

Healthy Eye



Diabetic Retinopathy



Diabetes is a serious medical condition characterized by high levels of glucose in the blood. Glucose is a simple sugar that comes from the food you eat. When your stomach digests food, glucose is absorbed into the bloodstream. The glucose circulates in your blood and serves as the main source of fuel for all the cells in your body.

Your Eyes and Diabetes

Diabetes is the leading cause of vision impairment among working age Americans. Diabetics, as a group, have 25 times the usual risk of vision loss. Diabetes causes damage to the fragile, small blood vessels in the retina and can lead to a disease called diabetic retinopathy.

5.7 million Americans are unaware they have diabetes. According to a report issued by the Centers for Disease Control, recent statistics show that there are approximately 24 million children and adults in the United States who are known to have diabetes. Unfortunately, another 5.7 million people are unaware they have the disease, and another 57 million Americans have “pre-diabetes,” defined by blood glucose levels above normal, but not reaching the level for diagnosis of diabetes.

UNDERSTANDING DIABETES

Diabetics can greatly reduce the possibilities of eye complications by scheduling routine examinations with an ophthalmologist. Many problems can be treated with greater success if caught early. If you or a loved one has Diabetes or simply a concern, call today for an appointment.

Type 1 Diabetes

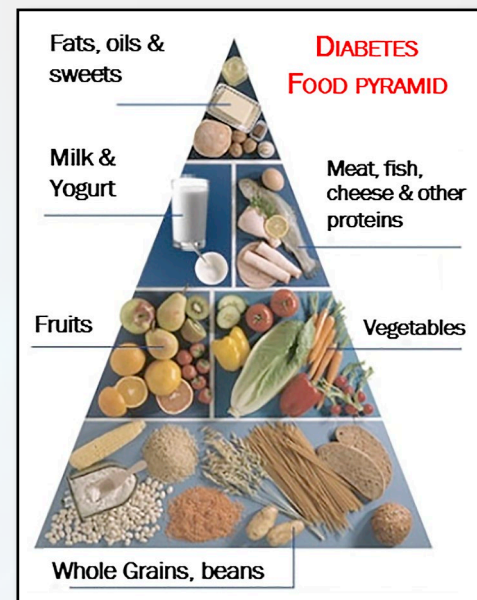
Type 1 Diabetes (also known as insulin-dependent diabetes) is an auto-immune disease where the body's immune system destroys the insulin-producing beta cells in the pancreas. This type of diabetes, also known as juvenile-onset diabetes, accounts for 10-15% of all people with the disease. It can appear at any age, although commonly under 40, and is triggered by environmental factors such as viruses, diet or chemicals in people genetically predisposed. People with type 1 diabetes must inject themselves with insulin several times a day and follow a careful diet and exercise plan.

Type 2 Diabetes

Type 2 Diabetes (also known as non-insulin dependent diabetes) T2DM is the most common form of diabetes, affecting 85-90% of all people with the disease. This type of diabetes, also known as late-onset diabetes, is characterized by insulin resistance and relative insulin deficiency. The disease is strongly genetic in origin but lifestyle factors such as excess weight, inactivity, high blood pressure and poor diet are major risk factors for its development. T2DM patients may have no symptoms or be minimally symptomatic, but still have damage to their eyes, heart, kidneys, brain and peripheral nerves from the high levels of circulating glucose. T2DM may be treated by dietary changes, exercise and oral medications. Insulin injections may also be required.

A Healthy Lifestyle

Begin with a healthy eating plan. Healthy eating means eating more whole grains, fruits, and vegetables, and less meat, sweets, and fat every day. Be physically active every day to help prevent weight gain and improve blood sugar control. Check the sugar in your blood and take your medication every day if needed.



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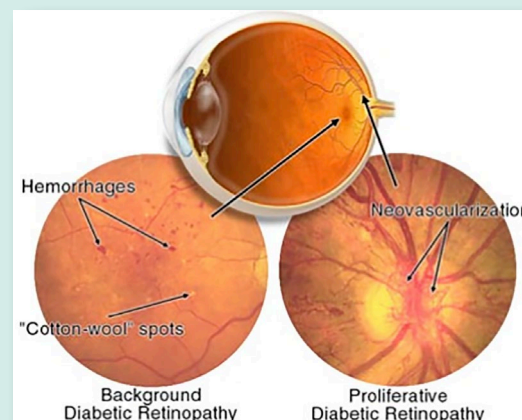
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How Does Diabetes Affect the Retina?

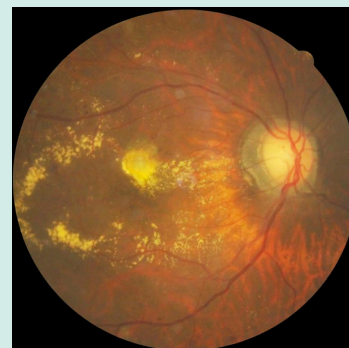
Diabetes can lead to damage of the retina – a condition called **Diabetic Retinopathy**. The longer a patient has diabetes the more likely he or she is to have diabetic retinopathy. However, some patients may already have diabetic retinopathy when they are diagnosed with diabetes. Over time, the high circulating levels of sugar in diabetic patients damage the circulatory system of the retina (and blood vessels throughout the body including the heart, brain and kidneys).

The earliest phase of the disease is known as **Background or Non-Proliferative Diabetic Retinopathy**. In this phase, the arteries in the retina become weakened and leak, forming small, dot like hemorrhages. These leaking vessels often lead to swelling or edema in the central region of the retina called the macula. This condition called diabetic macular edema can cause distortion and blurriness of the central vision.

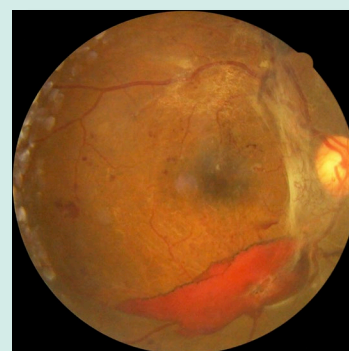
If diabetes is not well controlled, the damage from high blood sugar can cause the retina to become oxygen-deprived or ischemic. New fragile vessels develop as the circulatory system attempts to maintain adequate oxygen levels within the retina. This is called **Neovascularization** and results in **Proliferative Diabetic Retinopathy**. These delicate vessels hemorrhage easily and blood may leak into the retina and vitreous, causing spots or floaters, along with decreased vision. In the later phases of the disease, continued abnormal vessel growth and scar tissue may cause serious problems such as retinal detachment and glaucoma.



Diabetic Macular Edema



Proliferative Diabetic Retinopathy



Signs & Symptoms of Diabetic Retinopathy

- **Blurred Vision**
(this is often linked to blood sugar levels)
- **Sudden Loss of Vision**
- **Floaters and Flashing Lights**

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 diabetes. 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 lens in the eye. Cataracts develop at an earlier age in people with diabetes.

Glaucoma: increase in fluid pressure inside the eye that leads to optic nerve damage and loss of vision. A person with diabetes is nearly twice as likely to get glaucoma as other adults.

What is the Macula?

The macula is the central region of the retina located in the back of the eye. The retina is analogous to the film of a camera that captures an image. The retina contains a dense array of cells called photoreceptors that sense light and initiate signals to the brain to process visual information. The macula is responsible for our central vision including reading, writing, color vision and recognizing faces.

The macula, just like any other part of the body is subject to disease. For example, the macula can be swollen, wrinkled, or damaged by trauma. Systemic conditions such as diabetes and high blood pressure can damage the small blood vessels that supply the retina.

Age-Related Macular Degeneration (AMD)

The most common disease of the macula is age-related macular degeneration (AMD). AMD is a common condition in people age 50 years and older and is the leading cause of visual disability in individuals over age 65.

People suffering from AMD may experience blurriness and distortion in their central vision. For example, patients may note that lines appear wavy or letters are missing on a printed page. However, many people with AMD have no visual symptoms and may retain 20/20 vision indefinitely. A relatively small percentage of people will lose central vision and the ability to read and drive a car. Although AMD can cause central vision loss, it does not typically lead to complete blindness.

Two Types of AMD

Dry Macular Degeneration (Dry AMD)

Wet or Neovascular Macular Degeneration (Wet AMD)

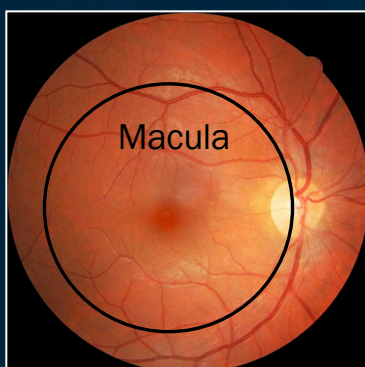
Dry AMD is more common, and accounts for 90% of all cases. Dry AMD is identified during an eye examination by the presence of drusen, which are small whitish-yellow deposits under the retina. These drusen can disturb the light-sensing cells of the retina.

Dry AMD is often asymptomatic but symptoms may include gradual loss of central vision, blurry or distorted vision, or blank spots in the vision. In some patients dry AMD will advance to central vision loss due to geographic atrophy which is the loss of the pigmented cellular layer under the macula. The treatment of geographic atrophy is an active area of research as there are currently no effective therapies.

Dry AMD is monitored closely as it can potentially convert to the more severe type called wet AMD. Your doctor will determine the frequency of examinations needed to monitor your condition.

Wet AMD is caused by the growth of new, fragile blood vessels that develop as the eye attempts to repair the damage of macular degeneration. However, these fragile blood vessels are more harmful than helpful and can leak and bleed leading to damage to the macula. Over time, scarring can develop which permanently impairs central vision. Medications that block the growth of these blood vessels can be injected into the eye by a retina specialist to stop further progression and vision loss.

Healthy Retina



AMD



Non-neovascular = DRY



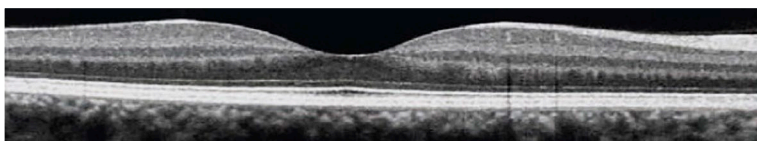
Neovascular = WET

Early Detection

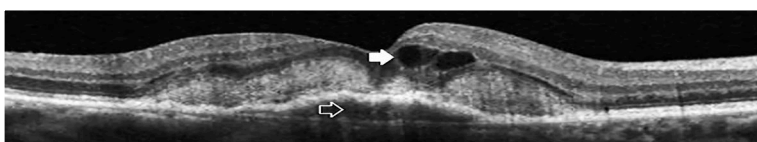
Macular degeneration can only be detected by having a complete dilated eye examination. If you are 60 or older or have a family member that has been diagnosed with macular degeneration, it is important to have your eyes checked yearly. With earlier detection, there is a better chance of maintaining vision.

The most significant risk factors for AMD are genetics (family history) and smoking. If you have a direct family member (mother, father, sister, brother) with AMD your risk for the disease is increased compared to the general population. If you are a smoker, your risk is more than 2 times greater compared to non-smokers.

Imaging the Retina with Optical Coherence Tomography (cross section of the retina)



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WET AMD

Dry AMD Treatment

The Age Related Eye Disease Study (AREDS) demonstrated that a specific formulation of antioxidant vitamins and minerals can modestly lower the risk of progression of dry AMD to more advanced stages of AMD associated with vision loss.

This formulation is available over the counter from several different manufacturers. It is important to check with your medical doctor before starting the AREDS 2 supplement. Of note, smokers should avoid any supplementation with Beta-carotene (included in the original AREDS formulation but not in AREDS 2) due to an increased risk of lung cancer.

Wet AMD Treatment

The prognosis for patients with wet AMD has improved considerably over the last decade with the advent of new pharmacologic therapies. There are now three different medications used by retina specialists to block the growth of new and leaking blood vessels. These medications inhibit Vascular Endothelial Growth Factor (VEGF) and therefore are called anti-VEGF agents. The anti-VEGF medications are given by an intraocular injection administered in the office. All three medications have been studied extensively in thousands of patients and appear to be comparably safe. Your doctor can discuss the optimal choice of medication with you.

Anti-VEGF Agents Include:

- Lucentis (ranibizumab)
- Eylea (aflibercept)
- Avastin (bevacizumab)

Dry AMD Supplement Formulation

The currently recommended formula based on the AREDS 2 study contains:

- 500 mg Vitamin C
- 400 IU Vitamin E
- 80 mg Zinc
- 2 mg Copper
- 10 mg Lutein
- 2 mg Zeaxanthin

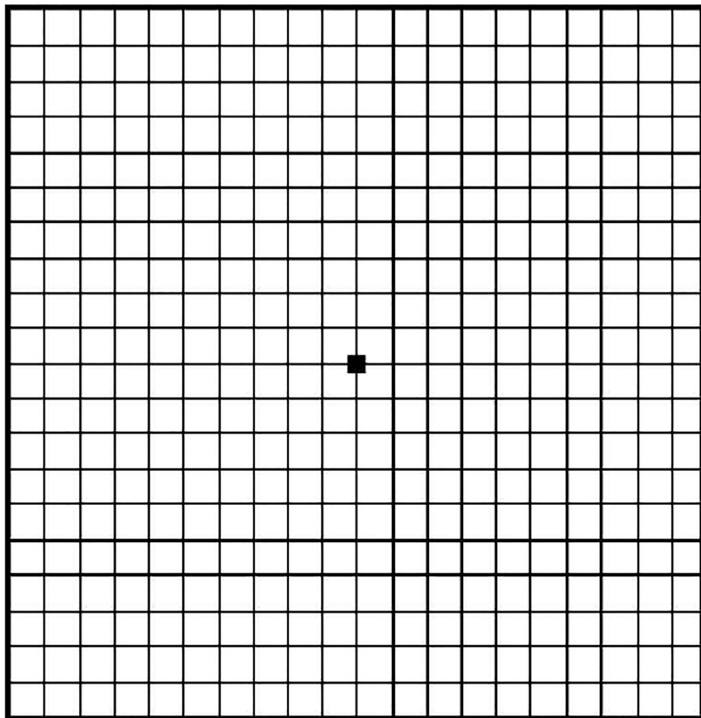


How to Use Amsler Grid:

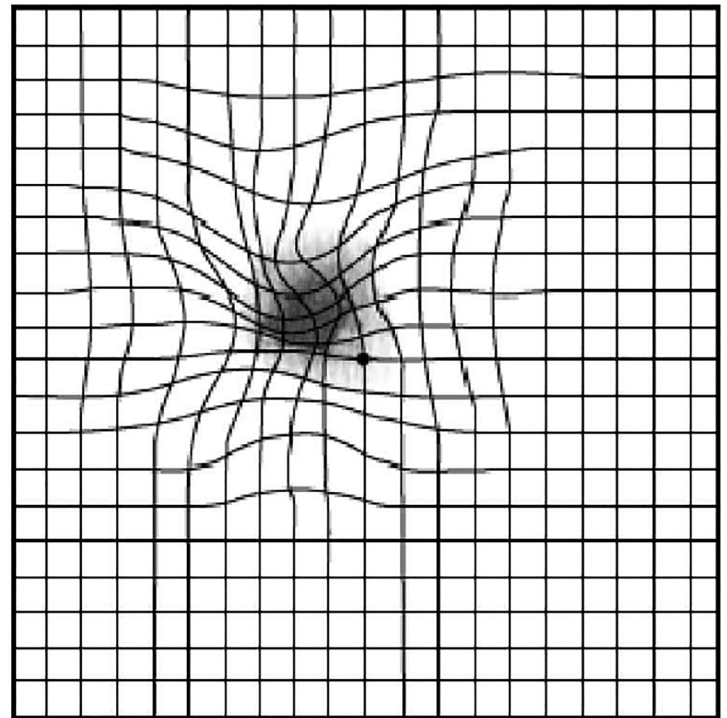
An **Amsler Grid** is a checkerboard that may be used to monitor for any changes in the macula. One eye is tested at a time with your reading glasses (if necessary).

During the test, you should concentrate on the center black spot and examine the checkerboard with your side vision. All the squares should appear straight with no distortion or missing areas.

Any changes noted in the Amsler Grid should be reported to your eye doctor immediately.



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**DISTORTION of GRID
with Wet AMD**

Low Vision Aids

Patients with advanced AMD may benefit from low vision aids to improve their quality of life. Low vision rehabilitation involves using specific magnifying optical devices and lighting aids to assist in performing specific vision functions. Although low vision aids do not cure AMD, they may help the patient perform essential visual tasks to make the most of the vision they do have. Your retina specialist can advise you on how to access low vision services.

Retinal Vein Occlusion

Retinal Vein Occlusion, or RVO for short, is a condition in the back of the eye where a retinal vein is blocked. Central retinal vein occlusion or CRVO is caused by blockage of the central vein that supplies the eye. Branch retinal vein occlusion or BRVO is caused by a blockage of a branch vein.

Blockage of a vein causes blood to be ‘dammed up’ and fluid leaks out of the vein into the surrounding tissue. This leakage causes swelling or edema of the retina. Edema can damage the retina and lead to loss of vision. RVO usually occurs with sudden and painless loss of vision, but in some cases the condition develops slowly over days or weeks.

It is also possible that the retina suffers a decrease in blood supply at the same time. This is called “ischemic” (from the Greek ‘bloodless’) RVO. In these cases, the retina becomes so “starved” for oxygen that new blood vessels grow in various locations in the eye to improve the insufficient blood supply. Unfortunately these new vessels are in dangerous locations and are fragile and not properly formed leading to a variety of problems including a very dangerous type of blinding glaucoma. Ischemic RVO is therefore considered the more severe form of the disease.

Causes of Retinal Vein Occlusion

- **Increased pressure in the eye called Glaucoma**
- **A hardened, sclerotic central retinal artery squeezing the soft pliable vein (caused by high blood pressure)**
- **Swelling of the optic nerve from inflammation**
- **Blood clotting disorders**

Who Gets Retinal Vein Occlusion?

BRVO and CRVO may occur at any age, but the majority of cases are seen in people over 50. Men seem to be affected slightly more often than women. There is no known way of prevention of RVO except treating the conditions predisposing to blood clots, such as diabetes, high blood pressure, and clotting disorders. Increasing age – another important risk factor – is, unfortunately, untreatable. Patients with retinal vein occlusion require evaluation by their primary care doctor to assess for treatable risk factors.

How to Diagnose a Retinal Vein Occlusion?

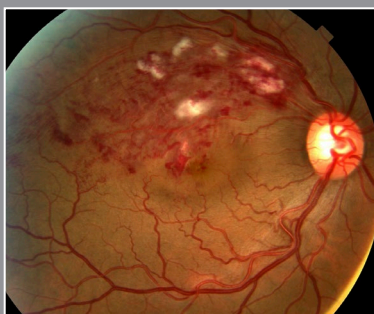
The most common symptom of RVO is vision loss or blurring in part or all of one eye. The vision loss or blurring is painless and may happen suddenly or become worse over several hours or days. Sometimes there is a sudden and complete loss of vision.

Floaters in your vision may be another symptom of RVO. When retinal blood vessels are not working properly, the retina grows new, fragile vessels that can bleed into the vitreous, the fluid that fills the center of the eye. Blood in the vitreous clumps and is seen as tiny dark spots, or floaters, in the field of vision.

In severe cases of CRVO, the blocked vein may cause painful pressure in the eye. Ischemic CRVO can also cause neovascular glaucoma. This type of glaucoma is caused when abnormal blood vessels begin to grow inside the eye, causing the pressure in the eye to rise. Neovascular glaucoma is a serious condition that can cause pain and lead to severe vision loss. It may take three months or longer after CRVO occurs for neovascular glaucoma to appear.

Treatment of RVO

Treatment of RVO can reduce the risk of permanent vision loss. Early treatment is important because once damage has occurred, the effects are more difficult to reverse.



Macula in Branch
Retinal Vein Occlusion



Macula in Central
Retinal Vein Occlusion

Monitoring Retina Health

Many patients with retinal conditions do not notice any symptoms or decrease in vision. Patients with retinal conditions should be monitored carefully by their eye doctor with the frequency of the exams determined based on the severity of the disease.

Medicated Treatments

Medicated treatments are typically injected into the vitreous of the eye by an ophthalmologist specializing in the retina. This type of treatment is most commonly used for diabetic retinopathy, wet age related macular degeneration (wet AMD) and retinal vein occlusion.

Anti - VEGF Medications

There are medications used by retina specialists to block the growth of new and leaking blood vessels in patients with retinal conditions. These medications inhibit Vascular Endothelial Growth Factor (VEGF) and therefore are called anti-VEGF agents. VEGF stimulates the growth of new and leaky blood vessels, which contributes to retinal edema. The anti-VEGF medications are given by an intraocular injection administered in the office. All three medications have been studied extensively in thousands of patients and appear to be comparably safe.

Steroid Medications

These medications reduce the inflammation in the eye that may contribute to the leakiness of blood vessels.

Surgical Treatments

In almost all cases, surgical treatments are necessary for retinal holes, tears or detachments. The type of surgery your surgeon recommends will depend on several factors, including how severe the condition is.

Surgical treatments for retinal conditions include:

- **Laser Photocoagulation**

A laser beam is directed into the eye through the pupil where it fuses the retina tissue to stop hemorrhaging or repair holes or tears.

- **Cryopexy**

After the eye is numb, a freezing probe is used to scar the retina. This helps secure the retina to the eye wall.

- **Vitrectomy**

Draining and replacing the fluid in the eye along with any tissue that is causing irregularities in the retina.

- **Pneumatic Retinopexy**

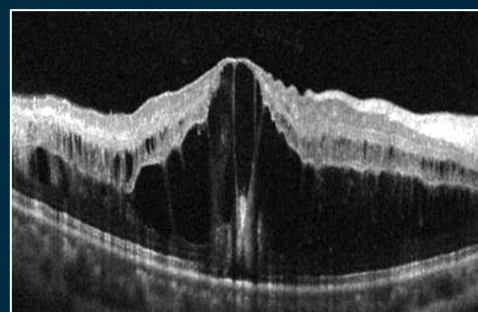
Injecting air or gas into your eye followed by cryopexy.

- **Scleral Buckling**

Indenting the wall of your eye to relieve some of the force of the vitreous pulling on the retina.



OCT of Macula in
Branch Retinal Vein Occlusion




OCT of Macula in
Central Retinal Vein Occlusion

Preparing for Injection

To prepare for an injection, the eye is cleaned with antiseptic solutions and numbed with topical anesthetic gel or an injection of anesthetic into the eye. Injections are administered according to the patient's response to treatment until the patient's vision is stabilized and the leaking blood vessels have dried up.

Ongoing treatment may be needed to control the disease. The frequency and number of injections needed varies considerably among patients. The risks of intraocular injections include hemorrhage, retinal tear, and infection, all of which are very rare. The injection of steroid medications may increase the risk of cataract and elevated eye pressure (glaucoma).



Patients should call their doctor if they experience increased pain or decreased vision in the days following an injection as these symptoms could indicate a serious infection.

Laser Photocoagulation

Thermal laser photocoagulation may be used in patients with diabetic macular edema or in patients with proliferative diabetic retinopathy.

The treatment of diabetic macular edema is called **Focal Laser Photocoagulation**. Focal laser treatment targets the abnormal blood vessels and microaneurysms that leak and bleed. Focal laser may be used as adjunctive treatment to anti-VEGF or steroid injections to allow for a longer duration of effect. However, focal laser can destroy surrounding tissue and can therefore only be used on leaking blood vessels outside the center of vision (called the fovea).

Panretinal photocoagulation (PRP) targets areas of the retina that are not receiving adequate blood flow and are sending signals to create new and abnormal blood vessels. PRP is used to treat patients with proliferative diabetic retinopathy who have certain high-risk characteristics.

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