LE Magazine February 2003

COVER STORY

Preserving Clear Vision

When aging individuals are asked what they fear most, one of the most frequently cited concerns is going blind or having a major loss of vision. Elderly people encounter staggeringly high rates of cataract, glaucoma and macular degeneration.

The good news is that degenerative eye disease is not inevitable. Scientific studies conclusively show that the risk can be mitigated via lifestyle and nutritional modifications. While major advances have been made in treating ocular disorders, there are still technological gaps that cause many to lose their precious vision. This article reviews the published literature and reveals new studies showing that common diseases of the eye are largely preventable.

Cataract surgery is virtually a rite of passage in aging Americans. Each year, 1.3 million cataractous lenses are surgically removed and replaced with synthetic lenses.1 The cost of all of these procedures combined has been estimated to be at least 3.5 billion dollars.

With the aging of the American population, it's likely that ophthalmologists who perform these surgeries will find themselves becoming progressively busier as cataract diagnoses climb in number. Cataract surgery has been perfected to the point where it is often viewed as simple surgery because complications are rare and recovery is generally rapid. The facts are that it is actually a complex and delicate surgery wherein things can and do go wrong during and after the surgery. Complication rates can vary significantly from surgeon to surgeon.

Even though complication rates are low, a small fraction of 1.3 million surgeries results in a significant number of people (about 26,000 to 28,000 people in the U.S.) being affected. These unfortunate individuals develop serious complications such as secondary glaucoma, detached retinas, corneal edema, severely compromised corneas requiring corneal transplants and internal eye infections that can cause possible complete loss of the eye.2-9 These complications can mandate hospitalization, and other major surgery to treat the complication.

Twenty to thirty percent of people who have cataracts removed and replaced with artificial lenses develop opacifications (clouding) of the lens capsule. This capsule was originally part of the patient's own lens but was left in the eye to hold the newly implanted lens in the proper position. Laser surgery is required to remove these opacifications and restore clear vision.

Why cataract is so common

In most body tissues, new, healthy cells are constantly replacing worn-out cells. The lens of the eye, however, experiences no turnover of cells at all-which means that the ones you have when you are born are the ones that you have to last you your lifetime.

The lens of the eye is composed mostly of protein and water, which forms a structurally clear tissue allowing light to pass through and focus on the retina. As we age the lens continues to grow and become less transparent to light. Long term photo (light) stress, oxidative stress, glycation and other factors can lead to severe distortions in the lens fiber proteins. The result is that proteins in the eye lens clump (crosslink), become oversaturated with water (water influx), and rupture in the cell fiber wall (bleb formation). All of this structural damage to lens proteins eventually creates opacity (inhibiting light transmission), which by definition is a cataract.

Symptoms of Cataract

As the cataract progresses it will lead to some or all of the following symptoms:

- Altered color vision (people

At first, symptoms may be so mild that the visual changes are attributed to a need for new glasses. Patients will often seek help for their visual changes and will be given a new pair of glasses, which will actually help because as the cataract develops it will cause the lens to swell changing the eyeglass prescription. Most doctors will not tell the patient that they have cataracts at this stage. Therefore, you must inform your doctor that you want to know about all lens changes-even small ones.

What causes cataract

Exposure to ultraviolet (UV) radiation is a well-known risk factor for cataract. Excessive UV exposure increases free radical formation in the lens, and can outpace the body's ability to subdue those damaging free radicals with antioxidants. optometrists and ophthalmologists almost universally recommend the use of wide-brimmed hats and sunglasses during sun exposure to minimize the amount of UV radiation that strikes the lens of the eye.

The link between poor nutrition and risk of cataract formation has been illustrated in a large number of clinical studies.10 A fair amount of research has linked shortages of specific nutrients to increased cataract risk, and shown that populations that consume higher levels of those nutrients have reduced risk.11,12 It is widely acknowledged that elevated free radical stress is also at least partially responsible for glaucoma and age-related macular degeneration, two other leading causes of blindness in aging individuals.

Diabetics are at particularly high risk for cataract. The high blood sugar levels found in diabetics have a direct effect on lens health, elevating oxidative stress and a destructive process called glycation.

Glycation is the pathogoical binding of sugars to proteins, which causes the resulting glycated proteins to produce 50 times more free radicals than non-glycated proteins. This heightened oxidative stress works, in turn, to accelerate glycation reactions-a vicious cycle. The end result of uncontrolled glycation is rapid organ aging and increased risk of a number of age-related diseases. Glycated proteins trigger a process called crosslinking, where proteins become bound together, causing them to become inflexible and less able to function in physiological systems.

It is likely that glycation plays a role in aging in non-diabetics as well, especially those who eat diets high in sugars and refined carbohydrates or those who have blood sugars higher than normal but not high enough to merit a diabetes diagnosis.

tell you that your clothes are mismatched or your hair is not its usual color, although you see the right colors when you look in the mirror).

- Feeling of looking through a clouded-over piece of glass.
- Increased sensitivity to glare from the sun or oncoming headlights.
- Increasingly blurred vision.
- Need for progressively brighter illumination in order to see clearly.
- Double vision when looking out of only one eye (the other eye is covered).
- Difficulty seeing in the dark.
- Vision that is brighter in one eye than in the other.

You are more likely to have cataracts if you:

- Have diabetes.
- Live in a sunny climate without regular use of hat and UV-blocking sunglasses.
- Have had to use topical or systemic steroid drugs.
- Have ever smoked heavily.
- Have generally poor nutrition.

Diabetes also causes increased activity of an enzyme called aldose reductase, which encourages clouding of the lens. It has been found that nutrients that inhibit the activity of this enzyme-specifically, the flavonoid nutrient quercetin-may slow the progression of diabetes-related cataracts.

Protecting the eye lens

A great deal is known today about the causes of cataract, and significant progress has been made in the search for inexpensive, non-invasive, low-risk methods to halt cataractogenesis and prevent cataracts from forming. Such a preventative therapy could help many aging people avoid surgery altogether and protect the millions who don't have access to surgery against blindness caused by cataract. There could be an added benefit of prevention of other blinding eye diseases, including glaucoma and age-related macular degeneration.

Nutrients that have been shown effective at protecting against cataract include carnosine, glutathione, taurine and cysteine; the antioxidant vitamins C, A and E; and vitamin B2 (riboflavin). The following paragraphs describe how each of these nutrients helps protect against loss of vision.

Carnosine

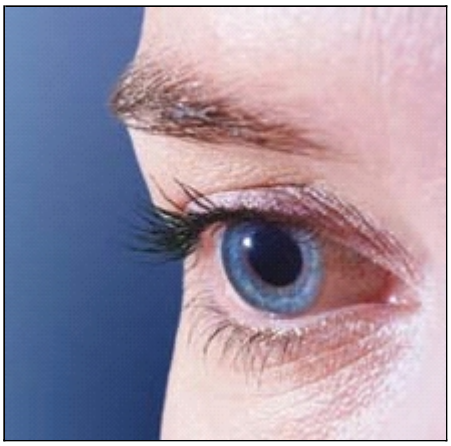
Carnosine is a free radical scavenger that is especially protective against lipid peroxidation.13 Since cell membranes are primarily comprised of fatty acids, carnosine helps maintain membrane function and cellular structure.

Carnosine's best-known effect, however, is its ability to prevent the formation of advanced glycated end products (protein

crosslinks). Carnosine competes with proteins for the binding sites they would occupy on sugar molecules, making it the best glycation preventative currently recognized in the world of nutrition research.

Carnosine has been found to significantly extend the life span of cultured cells and fruit flies, inhibit the toxic effects of the protein that accumulates in the brains of Alzheimer's patients, protect against the toxic effects of copper- zinc in the brain and enhance the state of balance (homeostasis) under which physiological systems work best. And, finally, it has been shown to prevent and/or reverse cataract.14,15

When administered topically to the eye in the form of N-acetyl-L-carnosine-(functionally, a time-release form of carnosine), this dipeptide can move easily into both the water-soluble (aqueous) and lipid-containing parts of the eye. Once there, it helps to prevent DNA strand breaks induced by UV radiation and enhances DNA repair.16 Once it has entered the lipid areas of the eye, N-acetyl-L-carnosine partially breaks down and becomes L-carnosine.



Chinese and Russian researchers have studied cataract-preventive nutrients for nearly a decade. A Chinese study done by A.M. Wang in 1999, used 96 patients aged 60 years or older having senile cataracts of various degrees of maturity with the duration of the disease from 2 to 21 years. Patients instilled one to two drops of the carnosine-containing solution in each eye three to four times each day for a period of treatment ranging from three to six months. The level of eyesight improvement and the change of lens transparency were considered as an evaluation index of the curative effect of carnosine. The result showed that carnosine gives a pronounced effect on primary senile cataracts, the effective rate being 100%. For mature senile cataracts, the effect rate was 80%.17

The Russians most recent contribution was published in 2002 in the journal Drugs Research and Development.18 In two separate studies, they applied a one percent solution of N-acetyl-carnosine to the affected eyes of cataract patients twice a day. Only patients with mild cataracts-not anticipated to require surgery within the next two years-in one or both eyes were selected to participate. A matched control group received placebo drops, and another small matched group received no drops at all. The first study lasted six months, while the second continued for a total of 24 months. Tests of visual acuity and glare sensitivity were administered every two months in the first study and every six in the second.

After six months, a full 90% of eyes treated with N-acetyl-carnosine showed improvements in visual acuity ranging from 7% to 100%. Glare sensitivity improved 27% to 100% in 88.9% of carnosine recipients, and image analysis (a measurement of visual clarity) improved in 41.5% of treated eyes. Lens examination revealed fewer areas of lens opacity in the posterior subcapsular region. No worsening of vision was found in the eyes treated with N-acetylcarnosine, and all of these benefits were sustained through the 24 months that treatment continued.

These study results are evidence that N-acetyl-carnosine is one of the most important nutrients for cataract prevention. The entire body of research on carnosine reveals its promise as an anti-aging nutrient that works at several levels to protect multiple organ systems.

Glutathione

The concentration of glutathione in the lens of the eye is higher than in most other tissues. It functions to protect the structural proteins and enzymes necessary for the maintenance of lens flexibility and clarity against free radical assault. Aging lenses or lenses that are under oxidative stress lose glutathione, and this shrinkage of the glutathione pool has been found to lead directly to reactions that cause crosslinking of proteins and lens opacification.19-26 L-carnosine and vitamin E have been shown to protect and restore these levels of glutathione. Oral supplements of NAC (n-acetyl-cysteine) and alpha lipoic acid help increase tissue levels of glutathione in the eye.

Taurine

High concentrations of taurine are needed within the eye to maintain optimal function and structure. It has been found to protect the lens against free radical damage.27,28 In a series of studies performed by researchers at the University of Maryland,27 rat lenses were cultured with a potent oxidant called menadione. The addition of physiological amounts of taurine-enough to create a concentration roughly equivalent to that which would exist in healthy lenses-attenuated the harmful effects of the oxidant. Another study found that the lenses of diabetic rats were protected against cataract by physiological levels of taurine.29

Vitamin C

Vitamin C protects the eye against damaging ultraviolet radiation and has been found to reduce the risk of cataracts.30 One study found that the higher the vitamin C intake, the less likely cataract was to develop. Women who used a vitamin C supplement for 10

years or more enjoyed the most protection.31
Vitamin C naturally exists in high concentrations in the aqueous humor (the fluid that fills the eyeball and filters light as it passes through to the retina) and the corneal epithelium (the outer layer of the front of the eyeball). Published studies indicate that consuming high doses of vitamin C orally provides substantial protection to your eyes.32-34

Riboflavin

Also known as vitamin B2, riboflavin is responsible for removing oxidized glutathione-glutathione that has been "used up" in the process of buffering free radicals and has become a free radical-bearing molecule itself-from the lens of the eye. Research published in the March 2000 issue of the journal Ophthalmology posited a role for the B family of vitamins as protectors against cataract,35 and a more recent epidemiological study found a link between riboflavin supplementation and decreased cataract risk.36 These new findings indicate that the oral consumption of riboflavin, along with other B-complex vitamins provides a considerable degree of protection against common degenerative ocular disorders.

Vitamin A

Long known to be essential for proper eye development, vitamin A continues to be important for the health of the eyes throughout the human life span, particularly the retina. Higher dietary intake of vitamin A has been found to decrease cataract risk.36 It-along with vitamin C and vitamin E-is also needed to regenerate oxidized glutathione. Antioxidants work cooperatively, regenerating one another as they are oxidized themselves in the process of buffering free radicals.37 Vitamin A has been used as a topical agent to treat contact lens problems and external eye disorders for some years now.

Vitamin E

Several epidemiological studies have found that higher intakes of vitamin E have a protective effect against cataract.38 Low serum levels of vitamin E correlate strongly with increased cataract risk.39 Researchers at the Institute of Biological Chemistry at the University of Catania in Italy found that chronic administration of vitamin E restored glutathione levels in aging rat lenses to those found in young rats.40 A study by a German research team found that vitamin E deficiency in the lenses of rats worsened the damage done by exposure to ultraviolet radiation.40

Looking at cataract prevention

Scientific findings continue to establish the benefits of antioxidants and anti-glycating agents in the prevention and treatment of cataract. For instance, research from the USDA Human Nutrition Research Center on Aging has demonstrated that antioxidants such as ascorbate, carotenoids and tocopherol, may protect against cataract formation. A five-year study of over 3000 Wisconsin residents, aged 43 to 86, showed that the risk for cataract was 60% lower among people who reported taking multivitamins or any supplement containing vitamin C or E on a long-term basis (more than 10 years) compared to non-users.32

While the evidence is compelling that individual nutrients reduce cataract risk, a more comprehensive approach would involve the oral ingestion of vitamin C, taurine, alpha lipoic acid, cysteine and riboflavin along with the topical application of carnosine, vitamin A and vitamin E directly into the eye. Carnosine, vitamin A and vitamin E are also important nutrients to ingest orally. More about this will appear later.

Alleviating
"Dry Eye"
Syndrome

A problem that affects people as they age is the onset of dry eye symptoms. This disorder is one of the leading causes for visits to the optometrist and ophthalmologist. Dry eye can be a very uncomfortable condition but generally does not lead to serious eye complications. One of the best treatments for dry eye symptoms is a good soothing eye drop. There are numerous drops on the market, many of which have toxic preservative systems that can actually make the problem worse with continued use. Additionally, some of these drops contain lubrication systems that will only stay in contact with the corneal epithelium (the outer layer of the cornea) for a few minutes. Most eye doctors that are oriented toward prevention will recommend an eye drop containing the lubricant glycerin and/or carboxymethylcellulose sodium plus other nutrients such as vitamin E, vitamin A, carnosine or glutathione. A drop of this combination will provide significant relief to dry, irritated eyes. It is estimated that 10% of all adults and 18% of elderly adults suffer from discomfort due to chronic eye dryness or irritation.* An eye drop containing the above listed ingredients-used one to four times daily will provide comfort and protection against dry irritated eyes and will provide the nutritional support needed by the aging eye.

* Chibret H. Dry eyes syndrome: reality and perspectives of treatment. Ann Pharm Fr 2002 Mar; 60(2):115-22.

Purchase Brite Eyes from the Life Extension Foundation

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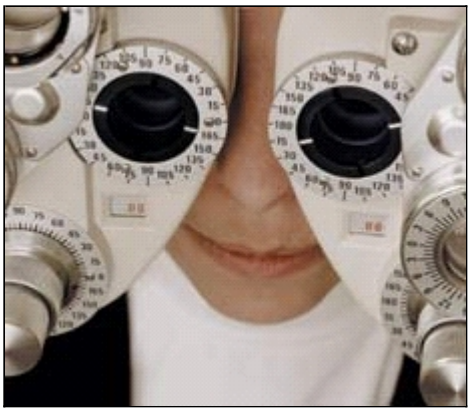
COVER STORY

Preserving Clear Vision

Macular degeneration

The macula is the central and most vital area of the retina. It records images and sends them via the optic nerve from the eye to the brain. The macula is responsible for focusing central vision that is needed for seeing fine detail, reading, driving and recognizing facial features.



Age-related macular degeneration is the leading cause of blindness in people over the age of 55, affecting more than 10 million Americans. It is a condition in which the central portion of the retina (the macula) deteriorates. It is equally common in men and women and more common in whites than blacks. The cause is unknown, but the condition tends to run in some families. Macular degeneration affects more Americans than cataracts and glaucoma combined.
There are two forms of macular degeneration: atrophic (dry) and exudative (wet). Approximately 85% to 90% of the cases are the dry type. Both forms of the disease may affect both eyes simultaneously. Vision can become severely impaired, with central vision rather than peripheral vision affected. The ability to see color is generally not affected, and total blindness from the condition is rare, but functional vision is very often lost.

There is little that can be done within conventional medical treatment protocols to restore lost eyesight with either form of the disease. Leading researchers, however, are documenting the benefits of a more holistic approach in the treatment of macular degeneration. Patients are being encouraged to increase physical fitness, improve nutrition (including a reduction in saturated fats), abstain from smoking and protect their eyes from sunlight. Dietary supplementation of trace elements, antioxidants and vitamins is recommended for improving overall metabolic and vascular functioning. Early screening and patient education offer the most hope for reducing the debilitating effects of the disease.

Exposures to sunlight and photochemical damage have been suspected factors in macular degeneration, as well as decreased antioxidant activity responsible for damage control.

An age-dependent drop in glutathione blood status and a significantly lower level of glutathione has been found in older individuals compared to younger ones. Moreover, an increase of oxidized glutathione by-product over time suggests more oxidation and the incumbent higher risk of age-related eye diseases.30 In the early stages of macular degeneration, glutathione has been found to protect retinal pigment epithelial cells from dying.41

Glutathione, which is particularly concentrated in the lens, has been shown to have a hydroxyl radical-scavenging function in lens epithelial cells.19
Lutein and zeaxanthin, the primary carotenoids concentrated in the macula, counter the free-radical forming action of light and

oxygen. It's been suggested that macular pigment protects the retina via a dual role that includes scavenging for free radicals and filtering out blue light, which can cause photochemical damage. Some studies have also suggested a link between dietary carotenoid intake and macular pigment density. In fact, eyes with age related maculopathy have revealed significantly lower carotenoid levels in the macula and retina than healthy eyes. Earlier studies had shown that eating dark leafy vegetables was associated with a 43% lower risk of macular degeneration.42

Other studies have been examining how antioxidant status relates to the risk of age-related macular degeneration. The Baltimore Longitudinal Study of Aging, for instance, found that tocopherol, and an antioxidant combination of tocopherol, carotene and ascorbate were protective. Researchers have also been looking at the potentially therapeutic role of individual compounds. For example, a study from Sete, France of 2584 inhabitants showed that higher plasma levels of alpha-tocopherol were inversely related to macular degeneration development and progression.43

The Age-Related Eye Disease Study Research Group43 has shown a protective effect against macular degeneration when higher doses of antioxidants and minerals are taken on a regular basis. The same can be said for cataracts as there is now ample evidence that indicate cataracts have in fact a nutritional connection. It, therefore, appears that prevention is the best solution to postponing or avoiding macular degeneration and cataract surgery. Most eye care professionals to date have told patients affected by these conditions that no treatment exists for macular degeneration and that surgery is the only treatment for cataracts. Emerging research, however, provides new hope for many of these individuals.

Diabetic retinopathy

One of the leading complications associated with diabetes is blindness or other eye diseases stemming from vascular damage to the eyes caused by high blood sugar. Diabetic retinopathy, the most common form of diabetes eye conditions, is caused by damage of the retinal blood vessels. This damage causes the ruptured vessels to leak fluid, restricting oxygen and blurring sight. As the disease progresses, the eye tries to form new vessels on the surface of the retina, which may also bleed or obscure sight by their mere presence. Diligently controlling blood sugar is a major means of preventing or at least slowing the onset and progression of diabetic retinopathy.

In diabetics, the vitreous body of the eye has been found to change more rapidly than with just normal aging. These changes have been implicated in functional disturbances and retinal detachment. The vitreous body is composed of a fine network of hyaluronan gel, collagen, proteoglycans and fibronectin, all of which are susceptible to free radical damage brought on by light and UV damage and glycation.44

A growing body of research shows that oxidation induced by glycation can wreak havoc on the eye. Protein glycation occurs when sugar molecules inappropriately bind to protein molecules, forming crosslinks that distort the proteins and consequently render them useless. Glycation appears to increase oxidative processes, which may explain why both glycation and oxidation simultaneously increase with age. High blood sugar also increases glycation activity, which may also explain the various kinds of tissue damage that characterize advanced diabetes.

Even before an individual is officially diagnosed with Type II diabetes, high serum insulin levels can induce retinopathy. Overweight individuals at risk for Type II diabetes should have their fasting insulin levels checked to guard against a pre-diabetic state (characterized by hyperinsulinemia) that can severely damage the eyes. By following a low glycemic diet, excess serum insulin can be reduced. More on lowering excess insulin will be discussed in an upcoming issue of this publication, but those concerned with diabetic retinopathy can view a new protocol by logging on to www.lef.org and looking under the Health Concerns section for the Retinopathy protocol.

Glaucoma

Glaucoma can result from the build-up of pressure in the aqueous humor, the liquid that fills the area between the cornea and the lens. Pressure build-up sometimes is not the whole story, as optic nerve damage can continue after pressure is returned to normal. It is thus critical to have an ophthalmologist check for optic nerve damage and not just abnormal intraocular pressures.
Glaucoma usually develops after age 40, although congenital glaucoma and physical injury to the eye can account for earlier age of onset. Figures show that one out of every 25 Americans suffers from glaucoma, and over 62,000 are legally blind due to glaucoma.

Age-related losses of antioxidants increase physical stress on the eye, and oxidative damage are underlying causes. For example, diminished antioxidant activity in lacrimal (tear) fluid and blood plasma seems to coincide with progression of glaucoma. It's also proposed that the rate of nerve damage increases as antioxidant capacity and protease activity declines with age.
In open-angle glaucoma, the common form of the disease, drainage of the aqueous fluid is sluggish. The backup thus causes undue pressure in the eye. The pressure pinches the blood vessels that feed the optic nerve, causing the nerve to die over time, leading to

Useful Supplements for Eye Health

Vitamin E
N-acetyl-cysteine
Vitamin C
Carnosine

decreased peripheral vision, tunnel vision and finally blindness. A less frequently encountered form of glaucoma is called narrow-angle or congestive glaucoma, whereby the flow of the aqueous liquid is blocked causing pressure to build up.

Evidence is slowly mounting to support the potential effectiveness of antioxidants against glaucoma. A Russian study of 64 patients with primary open-angle glaucoma found that a combined regimen of hyperbaric oxygen and antioxidants over a five-year period stabilized visual function in 80% of patients.45

To read Life Extension's revised Glaucoma protocol, log on to www.lef.org. Click the Health Concerns button and scroll down to Glaucoma.

Alpha Lipoic Acid
B complex vitamins
Glutathione
Beta carotene
Zeaxanthin
Lutein
Selenium
Zinc
Manganese

Preventing degenerative eye disease

Young eyes contain high concentrations of natural antioxidants that protect against cataract, macular degeneration and other ocular disorders. In the aged eye, synthesis of natural antioxidants such as glutathione is reduced, resulting in excessive free radical damage.

According to one published report, "nutritional intervention to enhance the glutathione antioxidant capacity… may provide an effective way to prevent or treat age-related macular degeneration." Even glaucoma has been linked with reduced blood flow and increased levels of damaging free radicals.

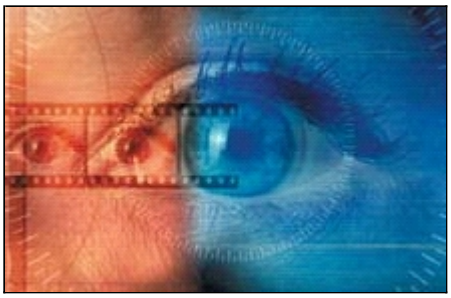
Another problem with aging eyes is protein degradation and the formation of advanced glycation end products. Aged eyes fail to break down and remove old proteins, which results in the accumulation of non-functioning protein crosslinks. The resulting accumulation of damaged proteins leads to senile ocular diseases.

The antioxidant supplements consumed by Life Extension Foundation members have been shown to provide considerable protection against senile eye disorders. Unfortunately, aging diminishes circulation to the eye, thereby denying the eyes the full benefits of orally ingested antioxidant and anti-glycating agents.

The good news is that topical eye drop preparations are now available to provide some of the most important nutrients directly into the eye.

Summary

If people live long enough, severe visual impairment or blindness is almost inevitable. Few people know that poor vision from cataracts affects 80% of people 75 years of age and older.



The eyes are particularly vulnerable to the effects of aging. Degenerative changes in the eye often begin in middle age. By age 70, a significant percentage of people suffer from macular degeneration, glaucoma and/or cataract. Diabetic retinopathy is also a major cause of visual disability among adults.

A review of the published scientific literature shows that common ocular disorders can be prevented with lifestyle modifications such as following a low glycemic diet, wearing UV blocking sunglasses, avoiding excess saturated fat and not smoking.

A compelling body of evidence indicates that orally ingested antioxidants and anti-glycating agents (such as carnosine) help to prevent and treat eye disease.
Scientific studies indicate that the topical application of certain nutrients may be helpful in the prevention and treatment of common senile eye disorders. In response to these published reports, eye drop solutions have been developed that contain specially designed antioxidants, lubricants and anti-glycating agents. A description of the newest of these topical eye drop preparations appears on the following page.

Purchase Brite Eyes from the Life Extension Foundation

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