Chapter 15: Smoking and the Eyes

American Council on Science and Health's ACSH book entitled “Cigarettes: What the Warning Label Doesn’t Tell You.”

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Many nonsmokers are acutely aware of the irritating effects smoking has on their eyes; they suffer burning, watering and reddened eyes in the presence of cigarette smoke. Few smokers, however, are aware of the many--and serious--eye diseases they may suffer as a result of their smoking. Smoking can cause or worsen over half a dozen eye conditions, some of which can lead to permanent vision loss.

In this chapter we will describe the eye diseases suffered by smokers and, when known, explain the possible mechanisms that account for them.

Smoking and Cataracts

At least 50 million people around the world lose vision as a result of cataracts. In the United States alone, cataracts annually claim at least part of the vision of 3.3 million people. When a cataract develops, it causes a loss of transparency in the eye’s lens, blocking some amount of light from passing through and focusing on the retina. This translates into a gradual, painless loss of vision. When cataracts are detected early, they can often be removed surgically and vision can be restored.

While a clouding of the eye's lens can occur as a result of the normal aging process, certain risk factors increase the likelihood of cataract development. Having diabetes and taking certain medications--corticosteroids, for example--both increase the chance that a person will develop cataracts. Smoking is another significant risk factor for cataracts. Compared with never smokers, current smokers of 20 or more cigarettes per day are at least twice as likely to develop any type of cataract and three times as likely to develop a particular type of cataract called posterior subcapsular cataract. This type of cataract is especially visually disabling due to its rapid development at the back of the lens, and, in conjunction with nuclear cataracts, is responsible for the majority of the 1.5 million cataract surgeries that are performed each year in the United States.

The smoker's risk of cataract increases with the amount smoked; consequently, cataracts are more serious in heavy smokers than in light smokers. A recent study has shown that, when compared to current smokers, men who had quit smoking within the ten years prior to the study had a 20% reduced risk of cataract diagnosis in the years that followed. However, those former smokers who had quit more than ten years before had little or no reduced risk when compared to current smokers. This information gives new hope that early discontinuation of smoking may mitigate additional damage to lens proteins and may possibly encourage a reversal of at least some of the early harmful effects of smoking.

Researchers remain uncertain as to whether cataracts develop as a result of external irritation from cigarette smoke; as a result of the biochemical effect of some constituent of smoke that is absorbed via the lungs and subsequently travels to the eye via the bloodstream; or as a result of some combination of the two.

Of the many proposed mechanisms for the smoking,cataract association, the destruction of antioxidant nutrients by metals such as iron and subsequent increased formation of oxidative-free radicals that cause cell damage are leading contenders. Environmental exposure to cigarette smoke has been proven to increase iron concentration and decrease zinc concentration in the lens of the eye. Due to zinc's antioxidant qualities, this depletion of zinc concentration following smoke exposure is indicative of the reduction of oxygen to oxygen-free radicals. Among their many other jobs, antioxidants play a critical role in maintaining lens transparency by preventing direct oxidation of lens proteins. They also prevent lipid peroxidation, a process that causes the breakdown of the fatty membranes that make up the lens of the eye.

In yet another theory, some researchers speculate that the metallic element cadmium found in cigarette smoke (tobacco leaves absorb and concentrate cadmium from the soil) plays a role in cataract development. It is possible that the cadmium binds with and damages the proteins in the lens.

Smoking and Graves' Disease

In Graves' disease, the thyroid gland becomes overactive, secreting too much thyroid hormone. Many sites of the body suffer negative effects, but eye complications are the most serious consequence of the disorder. Excess hormone can cause protrusion of the eyes, double vision, eye-muscle abnormalities and even permanent blindness.

When Graves' patients smoke, they have a nearly eightfold-increased risk of developing the eye complications as compared with nonsmoking Graves' patients. In addition, the smokers suffer the eye symptoms in a more severe form. As found with many of the other eye diseases that are induced or worsened

by smoking, there appears to be a direct association between total cigarette consumption and an individual's development of Graves' Disease.
The reason for smokers' increased risk of eye involvement in Grave's disease remains uncertain, but it may be due to a smoking-induced impairment of the immune system. Smoking changes the number of T cells produced in the immune system; it also causes the body to produce other types of cells that trigger inflammatory reactions in various sites in the body, including the eye. Because Graves' disease is, in fact, a disorder of the immune system, these latter possibilities are plausible. (See Chapter 19 for more detail on the components of the immune system.)

Smoking and Age-Related Macular Degeneration

Macular degeneration is damage to or breakdown of the macula, the small central area of the retina at the back of the eye that allows people to see fine details clearly. When the macula doesn't function correctly, vision becomes blurred and dark in the center; peripheral vision is generally not affected. Macular degeneration is the leading cause of blindness in adults over 65 and the most common cause of visual disability in most developed countries.

There is little effective treatment to prevent this serious condition, but there is one very controllable risk factor: smoking. Women who smoke appear to have about a 2.5-fold increase in risk of developing one form of macular degeneration--exudative macular degeneration, a more severe form of the disease that results in a more rapid and severe loss of vision. Men who smoke appear to have more than a threefold increased risk. In exudative macular degeneration, abnormal blood vessels form at the back of the eye. These new blood vessels leak fluid or blood and blur central vision. Smokers appear to be more likely to suffer this more severe form of macular degeneration and to suffer relapse after palliative laser treatment.

Smoking and Ocular Histoplasmosis Syndrome

Ocular histoplasmosis syndrome, an inflammation of the eye thought to be caused by a fungus commonly found in soil, is also associated with smoking: Heavy smokers suffer far more ocular histoplasmosis syndrome than do people who don't smoke.

Smoking and Abnormal Eye Movements

Smoking may cause nystagmus, or abnormal eye movements. These movements can include jerking and/or rhythmical oscillations (circular movements). The ingredient in cigarette smoke responsible for this hasn't been identified, but nicotine remains the most likely candidate. Nicotine may possibly cause nystagmus by disrupting the balance center (called the vestibular apparatus) of the brain.

Smoking and Diabetic Retinopathy

Smoking may accelerate the development of or worsen an eye complication associated with diabetes, diabetic retinopathy. In this disease, which can lead to blindness, the vessels that supply blood to the retina (a nerve layer at the back of the eye that senses light and helps send messages to the brain) are damaged by repeated high blood sugars. When these blood vessels become damaged, they may leak fluid or blood and grow scar tissue. Both the leaking of fluid and the growth of scar tissue can distort the images the retina sends to the brain. It is plausible that smoking worsens this condition because it, too, damages blood vessels (see chapters 3 and 4). A possible mechanism leading to damage to the blood vessels of the eyes is smoking-induced hypoxia. This condition is a result of diminished oxygen in the blood, with a corresponding increase in carbon

monoxide levels. Experts warn that low-nicotine cigarettes are not an answer, as their smoke actually contains a larger amount of carbon monoxide than does smoke from higher nicotine cigarettes.

Smoking and Optic Neuropathy

Anterior ischemic optic neuropathy is an eye disease that results in a sudden, painless loss of vision, often leading to permanent blindness. It occurs because of compromised blood flow, or even a total lack of blood flow, in specific arteries that supply the eyes. Experts believe that atherosclerosis--the clogging of arteries--in the optic area may play a role in causing this disease.
It has recently been discovered that smoking is a significant risk factor for developing this serious eye disease. Smokers are at a 16-fold increased risk of developing anterior ischemic optic neuropathy as compared with nonsmokers. In addition, smokers develop the disorder at younger ages; in one study smokers were found to develop the disease at an average age of 51 and nonsmokers at an average age of 64.

Smoking and Optic Neuritis

The optic nerve carries messages from the eye to the brain. This nerve critical to vision is like a cable of electrical wires; it consists of about 1.2 million separate tiny nerve fibers, each of which is a conduit for part of the brain’s message. Vision is not normal unless the overwhelming majority of these tiny fibers work properly and are healthy. In optic neuritis, the optic nerve becomes inflamed, or swollen and red. When a significant number of the tiny fibers in the optic nerve become inflamed, vision may be affected. People who suffer from optic neuritis may have pain, blurred vision and/or a blind spot in their vision.

Smokers with optic neuritis are far more likely to develop an additional defect: specifically, a red/green color defect in the affected eye. While experts are not sure of the mechanism for this, they propose that the red/green defect occurs because of the relative lack of oxygen reaching the eye in smokers as compared with nonsmokers.

Tobacco Amblyopia

Smoking may result in tobacco amblyopia, or a loss of vision in both eyes. For many years experts thought this rare condition could occur only if malnutrition, alcoholism or a disorder of vitamin B12 metabolism also existed. Two fairly recent case reports, however, have suggested that tobacco amblyopia can occur independent of these other conditions. Cessation of smoking can result in a total cure.