

**OPTOMETRY—WHAT IT INVOLVES AND HOW IT
RELATES TO OTHER HEALTH PROFESSIONS**

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The purpose of our project is to develop a slide-based presentation which can be used not only to educate beginning health professionals about the scope of optometry but also to demonstrate how these professionals may become involved with optometrists in their health-related field. Many of these future health care providers think of optometrists as people who merely provide glasses and contact lenses. They do not realize that optometrists diagnose and treat ocular disease, provide vision therapy, and prescribe low vision devices. In doing so, optometrists can work with physicians, x-ray or laboratory technicians, and even occupational therapists just to name a few. So, this presentation will explain what optometry is all about and how optometrists can work with other health professionals to provide the best patient care possible.

In order to do this, a number of different topics are included and the talk can be tailored to each individual group, depending on the group's interests and health field. We gave the presentation to the students at the Mecosta-Osceola Intermediate School District Health Careers Occupation Program. All of the students were interested in pursuing some type of health-related career. Some of their interests included laboratory and x-ray technicians, occupational therapists, and veterinarians. Because of this, our presentation covered all of the topics in the outline. Following is a comprehensive outline and lecture for a group with varying interests, like our audience. Or, as mentioned above, the outline and lecture can be altered easily to focus on a more specific area such as when presenting to a more focused group made up solely of laboratory technicians or family physicians.

In addition to the outline and lecture, slides of various conditions are included. These help to maintain attention and make the presentation more clinical. The use of eye models, schematic eye drawings, low vision devices, and contact lenses is also encouraged to bring about group participation. The eye models and drawings also help to familiarize the group with the parts of the eye and their functions. The low vision devices and contact lenses give the participants some hands-on experience with items with which they may not be accustomed but some of their patients may utilize.

Finally, a short question and answer session may be included at the end of the presentation. This will allow for specific questions that may not have been answered during the presentation. So, whether the presentation is used for a classroom of health care providers with different interests or for a specific group interested in one area, it can be used to educate and inform other health professionals on the abilities of optometrists and how we use these abilities to work with other health care professionals to deliver the best patient care possible.

OPTOMETRY - WHAT IT INVOLVES AND HOW IT RELATES TO OTHER HEALTH PROFESSIONS

I. THE THREE "O's"

A. Ophthalmologists

1. Four years of undergraduate work, four years of medical school, and a three year residency
2. Additional training required for specialization in cornea, retina, etc.
3. Perform surgery, diagnose and treat disease, prescribe glasses, contact lenses and low vision devices

B. Optometrists

1. Three to four years of undergraduate work, four years of optometry school
2. Residency program is optional in order to specialize or educate
3. Diagnose and treat disease, perform vision therapy, prescribe glasses, contact lenses and low vision devices

C. Opticians

1. Two year opticianry program - associates degree in applied science
2. Many continue to obtain a bachelors degree in business
3. Frame and lens selections for patients, cut lenses to fit the frame, adjust and repair frames

II. JOB OUTLOOK AND SALARIES

A. Location, Location, Location

1. States with an above average ratio (11-13 active optometrists per 100,000 population: CA, IL, PA, TN)
2. States with a critical ratio (less than 7 active optometrists per 100,000 population: GA, LA, NJ, TX)

B. Modes of Practice and Varying Wages

1. One year residency program - approximately \$20,000 annually
2. Private practice
3. Health maintenance organization (HMO)
4. Military
5. Hospital or veteran's administration medical center
6. Ophthalmologist employed
7. Corporate - approximately \$80,000 annually

III. FAMILY PHYSICIANS

A. Systemic Diseases Affecting the Eye

1. Hypertension (S-1)*
 - a. early - AV crossing changes and arteriolar narrowing
 - b. late - cotton wool spots, hemorrhages, and exudates
2. Hyperlipidemia (S-2, S-3)
 - a. normal aging change - arcus senilis
 - b. Hollerhorst plaques, artery occlusion, and ischemia
3. Diabetes (S-4, S-5)
 - a. early - vision fluctuations
 - b. late - hemorrhages, cotton wool spots, neovascularization

B. Sexually Transmitted Diseases Affecting the Eye

1. HIV/AIDS
 - a. Kaposi's sarcoma
 - b. vitritis
 - c. retinitis
2. Herpes Simplex Virus
3. Chlamydia
4. Syphilis

*Indicates slide number

IV. PEDIATRICIANS

A. Examination of an Infant or Young Child

1. Objective testing
 - a. retinoscopy
 - b. ophthalmoscopy

B. Problems Secondary to Prematurity

1. High refractive errors
2. Retinopathy of prematurity (ROP)

C. Congenital or Infantile Abnormalities of the Eye

1. Leukocoria (S-6)
 - a. retinoblastoma
 - b. retinopathy of prematurity (ROP)
 - c. persistent hyperplastic primary vitreous (PHPV)
2. Strabismus
 - a. exotropia or esotropia (S-7)
 - b. amblyopia
 - c. suppression

V. NURSES

A. Ability to Detect Vision Loss

1. First and last to see patient in the office
2. Observation of mobility and head posture

B. Responsible for Patient Education of Diseases and Effects on the Eye

1. Diabetes
2. Hypertension
3. Hyperlipidemia
4. Sexually transmitted diseases

VI. X-RAY, CT, MRI TECHNICIANS

A. Uses of X-rays

1. Intraorbital Metal Foreign Bodies (S-8)
2. Sarcoidosis

B. Use of CT Scans and MRI's

1. Location of tumor
 - a. intraorbital tumors
 - b. intracranial tumors
 - i. optic nerve glioma (S-9)
2. Entrapped muscle

VII. LABORATORY TECHNICIANS

A. Differentiating Organisms Infecting the Eye

1. Allergic reaction (S-10)
 - a. symptoms: itchy eyes with a thick ropy discharge
 - b. conjunctiva: chemosis, hyperemia, mild papillae
 - c. usually no corneal involvement
2. Viral infection
 - a. symptoms: photophobia and watery discharge
 - b. conjunctiva: follicles
 - c. preauricular lymphadenopathy
 - d. corneal infiltrates (S-11)
 - e. Example: Herpes simplex dendrite (S-12)
3. Bacterial infection
 - a. symptoms: gritty eyes, mucopurulent discharge, very red eye
 - b. conjunctiva: papillae, chemosis, hyperemia
 - c. Examples: congenital syphilis (S-13) and secondary syphilis
4. Fungal infection
 - a. symptoms: vary, history of contact with vegetable matter
 - b. conjunctiva: rarely affected
 - c. corneal lesion with finger-like projections
5. Parasitic infection
 - a. Chlamydia
 - i. symptoms: watery or mucus discharge, history of new sexual partner or genitourinary involvement
 - ii. conjunctiva: follicles or papillae
 - iii. possible preauricular lymphadenopathy

- b. Acanthamoeba (S-14)
 - i. symptoms: severe pain, history of using homemade saline solution or recent use of hot tub or pool
 - ii. conjunctiva: not involved
 - iii. breakdown of corneal epithelium

B. Detecting Drug Resistance and Sensitivity

VIII. OCCUPATIONAL THERAPISTS

A. Role in Low Vision

1. Teaching basic living skills
2. Teaching how to function on the job

B. Different Types of Patients Encountered

1. Age Related Macular Degeneration (ARMD)
 - a. patient loses central vision
 - b. must learn to eccentrically fixate
2. Retinitis Pigmentosa (RP)
 - a. patient loses peripheral vision
 - b. must learn to use central vision and turn head

C. Types of Low Vision Devices Used

1. Telescopes - driving and long distance viewing
2. Microscopes - reading and near viewing
3. Closed Circuit Television (CCTV) - reading and near viewing
4. Large print books, telephones, appliances

IX. VETERINARIANS

A. MD's Specialize in Animals

1. Cataract surgery

B. Fun Facts

1. Dogs - color blind
2. Cats - vertical pupil for easy up and down viewing
3. Horses - horizontal pupil for sideways viewing, 2X larger than human eye

4. Fish - no tear glands or eyelids
5. Camels - four inch eyelashes
6. Eagles - have the best sight of all animals, eye larger than human eye and weighs more than its brain

X. ENVIRONMENTAL FACTORS

A. Ultraviolet Light

1. Solar macular burn (S-15)
2. Pinguecula
3. Pterygium (S-16)

B. Smoking and Smoky Environments

1. Dry eye and intolerance to contact lenses
2. Age related macular degeneration
3. Low birth weight babies

C. Alcohol

1. End point nystagmus

D. Medication

1. Posterior subcapsular cataract (PSC) (S-17)
2. Dry eye
3. Corneal deposits
4. Bull's eye maculopathy

E. Trauma

1. Rosette cataract (S-18)
2. Blow-out fracture
3. Subconjunctival hemorrhage (S-19)
4. Corneal foreign body (S-20)
5. Abrasions and perforations

F. Refractive Surgery

1. Radial Keratotomy (RK) (S-21)
2. Photorefractive Keratectomy (PRK) (S-22)

SLIDES

<u>Slide Number</u>	<u>Page*</u>	<u>Figure</u>	<u>Description</u>
1	K 329	10.54	hypertensive retinopathy
2	S 6.25	6.58	arcus
3	K 325	10.49	Hollenhorst plaque
4	K 305	10.5	background diabetic retinopathy
5	K 312	10.20a	proliferative diabetic retinopathy
6	K 402	13.22	leukocoria (retinoblastoma)
7	K 15	1.29	congenital esotropia
8	S 20.19	20.55	x-ray (BB in orbit)
9	K 450	15.18	CT scan (optic nerve glioma)
10	K 73	4.19	vernal conjunctivitis
11	S 4.3	4.5	infiltrates (Adenovirus)
12	K 99	5.13	Herpetic dendrite
13	S 10.22	10.59	congenital syphilis
14	S 6.14	6.29	Acanthamoeba
15	S 16.2	16.1	macular solar burn
16	K 79	4.3	pterygium
17	S 6.1	6.19	corneal foreign body
18	S 11.12	11.32	rosette cataract
19	S 3.5	3.12	subconjunctival hemorrhage
20	S 11.10	11.25	posterior subcapsular cataract
21	S 6.29	6.68	RK
22	S 6.30	6.71	PRK

* K indicates slide is taken from Kanski, **Clinical Ophthalmology**, 2nd ed.

S indicates slide is taken from Spalton, **Atlas of Clinical Ophthalmology**, 2nd ed.

OPTOMETRY--WHAT IT INVOLVES AND HOW IT RELATES TO OTHER HEALTH PROFESSIONS

The main eye care professionals, or the three "O's", include ophthalmologists, optometrists, and opticians. Each group has different levels of education yet the skills and abilities of the groups overlap. Ophthalmologists go through four years of undergraduate work, four years of medical school, and a three year residency program. Many do additional training in order to specialize in one area such as the cornea or retina.

Ophthalmologists perform surgery for cataracts, strabismus, corneal transplants, and refractive surgery. They also diagnose and treat disease and prescribe glasses.

Optometrists attend three to four years of undergraduate work and four years of optometry school. A residency program is optional and may be done if the optometrist plans to specialize in one area or to become a professor at a college of optometry.

Optometrists not only prescribe glasses and contacts but also diagnose and treat disease, perform vision therapy, and prescribe low vision devices. Opticians enter a two year program and receive an associates degree in applied science. Many continue their college education and obtain a bachelors degree in business. Opticians work with patients to select frames and lenses, cut the lenses to fit the frame, and adjust and repair frames. All three eye care professionals play an important role in patient care.

Upon graduation, most optometrists in the United States do not have much difficulty finding employment. Many opportunities exist to network among practicing optometrists and students, so graduates have many avenues to pursue. Location is important, however. Some states have more than enough eye care practitioners while some are in desperate need of optometrists. Examples of states with an above average

ratio (11-13 active optometrists per 100,000 population) are: California, Illinois, Pennsylvania, and Tennessee. Examples of states with a critical ratio (less than 7 active optometrists per 100,000 population) are: Georgia, Louisiana, New Jersey, and Texas.

Students graduating from an accredited college of optometry can expect a salary that ranges from \$20,000 to \$80,000 per year whether they complete a residency program or work in a corporate setting, respectively. As you can see, the mode of practice greatly influences the optometrist's salary. Some of these modes of practice include: 1) residency—a one year program which trains a graduate for a specialty, research, or academia, 2) private practice, 3) a health maintenance organization (HMO), 4) the military, 5) hospitals or veteran's administrations, 6) working with an ophthalmologist or, 7) corporate optometry such as NuVision or D.O.C.. Optometric specialties include low vision, pediatrics, vision therapy, contact lenses, and ocular disease.

Whether or not an optometrist specializes in ocular disease, he must be aware of the signs and symptoms of the many systemic diseases that affect the eye. Communication between optometrists and general practitioners regarding patients with such diseases is crucial. For example, hypertension and high blood lipid levels can have devastating effects on the eye. They alter the small vessels found in the retina. Hypertension causes the appearance of the vessels to change depending on the duration and severity of the disease. Early ocular signs of systemic hypertension include arteriovenous (AV) crossing changes and narrowing of retinal arterioles. The narrowing may be diffuse or focal. Severe narrowing can lead to a decreased oxygen supply to certain areas of the retina. This leads to whitish colored lesions called cotton wool spots. Abnormal vascular permeability leads to hemorrhages and hard exudates, or deposits in the retina.

Hyperlipidemia can also show ocular manifestations. The lipid deposition first appears in the superior and inferior perilimbal cornea and eventually forms a complete band with a sharp edge peripherally and a diffuse edge centrally. The band is separated from the limbus by a narrow area of clear cornea. In patients between the ages of 40 and 60, this band is called arcus senilis and is considered a harmless age-related change. In younger patients, however, this band is often a sign of systemic hyperlipidemia, in particular increased blood cholesterol levels.

Increased blood cholesterol levels can cause more serious complications such as retinal artery occlusions. The cholesterol emboli, called Hollenhorst plaques, originate from the internal carotid artery and eventually make their way to the central retinal artery, leading to arteriolar occlusion and retinal ischemia. These emboli are small and, therefore, rarely cause symptoms. However, the emboli can be detected near the bifurcation of retinal arteries by an optometrist during a routine eye examination.

Diabetes is another relatively common disease that can affect the eye. A patient with undiagnosed diabetes may report that his vision tends to fluctuate throughout the day. At this time, his doctor could further question the patient as to whether he has been eating, drinking, or urinating more often than usual. These three symptoms, along with the fluctuation in vision, are suggestive of diabetes. The doctor can order the proper tests to determine if the patient has diabetes. And patients with diabetes should be followed regularly by an optometrist. This is because in addition to causing a fluctuation in vision, diabetes affects retinal small blood vessels, leading to dot or blot hemorrhages, cotton wool spots, neovascularization, or more serious complications. An optometrist can detect early ocular signs and prevent permanent damage. So, hypertension, increased cholesterol

levels, and diabetes are just three of the many systemic diseases showing significant ocular signs that can be detected by an optometrist. Primary care physicians can inform patients of ocular effects that these diseases cause and stress the importance of regular eye examinations.

Moreover, sexually transmitted diseases can infect the eyes. A majority of patients who have Acquired Immune Deficiency Syndrome (AIDS) show ocular manifestations. External signs may include Kaposi's sarcoma, a bright red mass involving the eyelids or conjunctiva. Kaposi's sarcoma may also appear as elevated, non-tender purple nodules on the skin. Herpes zoster ophthalmicus may be seen in AIDS patients, causing a severe and prolonged uveitis. Dilated fundus examination may reveal a vitritis caused by candida, toxoplasmosis, or cytomegalovirus (CMV). CMV also causes a characteristic retinitis with the so-called "ketchup and cottage cheese" appearance. This characteristic appearance is caused by cotton wool spots and scattered retinal nerve fiber layer hemorrhages. CMV retinitis is the major cause of vision loss in patients with AIDS. Its appearance is a poor prognostic sign as most patients die within 6-8 weeks. Herpes, chlamydia, and syphilis can also affect the eyes. These topics will be discussed later.

Family physicians are not the only doctors that work with optometrists. Pediatricians should be familiar with ocular conditions that affect children. They can make referrals to the appropriate eye care practitioner upon discovery of a problem. The optometrist or ophthalmologist can examine the patient with the use of a retinoscope, dilating drops, and an ophthalmoscope. With the retinoscope, the refractive error is obtained without the patient's subjective responses. With dilating drops and ophthalmoscopes, the integrity of the retina and other structures can be seen easily.

These techniques can be used to examine premature babies who are at risk for several disorders, such as high myopia due to long axial lengths which must be monitored for retinal detachment. In addition, the eyes of all infants born at less than 36 weeks or weighing less than 2000 grams who have received supplemental oxygen should be screened for retinopathy of prematurity (ROP). The retina has no blood vessels until the fourth month of gestation. The vessels then grow from the optic nerve head to the periphery. Those growing nasally reach the periphery after eight months of gestation, while the temporal vessels do not reach the periphery until one month after delivery. This incompletely vascularized retina is extremely susceptible to oxygen damage, especially in the premature. The oxygen causes fibrovascular proliferation which can lead to retinal detachment, scarring, and dragging of the disc. Fortunately, the rate of spontaneous remission is high. In those that progress, cryotherapy, scleral buckling and vitamin E are some of the treatments used.

Another condition that pediatricians can observe is leukocoria. Leukocoria, or white pupil, is the most common mode of presentation in a child with retinoblastoma. Retinoblastoma is the most common primary malignant intraocular tumor of childhood. The tumor usually presents unilaterally, with one in three cases eventually becoming bilateral. Whether one or both eyes are affected, early detection and treatment are crucial to prevent metastasis.

Leukocoria may be seen in other disorders as well. Examples include retinopathy of prematurity (ROP) and persistent hyperplastic primary vitreous (PHPV), a failure of the primary vitreous to regress during development. While these conditions are relatively benign and may not require any treatment, the leukocoria they cause must be differentiated

from the leukocoria caused by a retinoblastoma. And since many parents take their newborns in regularly to see a pediatrician, while few take their newborns to see an optometrist, it is very important that the pediatrician looks for and recognizes such a significant yet easily detected sign. He can then refer the patient to an optometrist for further evaluation of the leukocoria.

In addition, a child may have strabismus, a misalignment of the eyes in which one eye turns either in or out. This can lead to other complications such as amblyopia or suppression. Amblyopia is decreased vision that is not correctable with spectacles. Suppression is a sensory adaptation in which the image from the deviated eye is ignored or “turned off” to eliminate subjective diplopia. These problems can be reduced or avoided if an alert pediatrician observes the eye turn and refers the patient to an eye care specialist.

Furthermore, nurses play a vital role in health care today. Often, they are the first and the last people to see a patient. When escorting the patient to the exam room, a nurse may suspect a vision problem by observing his mobility or head posture. If the patient bumps into things or uses the wall as a guide, a referral for a vision evaluation should be made. If the patient has a severe head turn or tilt, it could indicate a muscle problem and again a referral is needed.

Nurses often have the responsibility of explaining systemic disease and treatment plans to the patient. In doing so, nurses can provide patient education regarding ocular complications of systemic disease. Information should include: vision fluctuation and hemorrhages with diabetes, arterial changes and ischemia with hypertension, retinal artery and vein occlusion with hyperlipidemia, and red eyes with sexually transmitted diseases.

The nurses can encourage the patient to have regular eye examinations to monitor the health of the eyes and look for such complications.

Optometrists can be involved with x-ray technicians as well. A person who shoots BB guns may accidentally get hit in the eye with a BB, a high speed metal projectile which could penetrate the globe or enter the orbit. An x-ray could be taken to confirm the presence and location of the BB in the globe or orbit. Once he has viewed the x-ray, the optometrist could then consider the treatment options and monitor the situation.

Next consider sarcoidosis—a disease that affects many organ systems such as the skin, eyes, and lungs. A person with sarcoidosis may develop a characteristic skin rash, called erythema nodosum, which is often found on the legs. He may also have certain ocular signs suggestive of the disease. Such signs may include any of the following: lacrimal gland infiltration, follicular and/or phlyctenular conjunctivitis, recurrent iridocyclitis, and peripheral retinal periphlebitis which can lead to exudates referred to as "candlewax drippings". An optometrist that finds any of these ocular signs suggestive of sarcoidosis can refer the patient to his primary care physician who will order an x-ray and look for the hallmark sign of sarcoidosis--a bilateral hilar lymphadenopathy. At that point the physician can diagnose the patient with sarcoidosis or order more tests to determine what is causing the suspicious eye signs found by the optometrist.

Not only is an x-ray a useful tool for optometrists and primary care physicians to diagnose certain diseases, but CAT scans and MRIs can be used in patients with a tumors or blow-out fractures. These patients often experience double vision and will therefore seek the advice of an optometrist. Tumors can be located intraorbitally or intracranially, such as an optic nerve glioma. Blow-out fractures occur secondary to blunt trauma and

are discussed later. In either case, the optometrist can perform tests such as versions, forced vergences, and exophthalmometry to differentially diagnose causes of diplopia. He can then refer the patient for a CAT scan or MRI to look for the tumor or entrapped muscle.

Optometrists and laboratory technicians work together, especially with the new laws allowing optometrists to treat disease. When a patient comes in with a red eye, the cause of the red eye could be allergic, viral, bacterial, fungal, or even parasitic. All of these different causes of red eyes have characteristic signs and symptoms. For example, a patient with an allergic reaction will complain of very itchy eyes with a thick ropy discharge. Upon examination by an optometrist, he may find conjunctival chemosis or hyperemia along with a mild papillary reaction. The cornea is usually not involved.

Viral and bacterial infections must also be considered when a patient comes in with a red eye. A viral conjunctivitis causes a watery discharge and photophobia. The eyelids can be edematous. The conjunctiva shows a follicular response and the preauricular lymph nodes are often swollen. The cornea may show diffuse punctate staining or corneal infiltrates, focal white lesions that may be an immune response to the virus. Herpes simplex shows a characteristic dendritic lesion on the cornea which helps diagnose this particular infection.

Bacterial infections cause a mucous discharge. One of the main symptoms the patient will present with is that his eyes are matted shut in the morning. His eyes will also feel gritty. The optometrist may see conjunctival papillae, chemosis, and hyperemia most prominent in the fornices. Some bacterial infections, such as congenital syphilis, can even affect the retina. Congenital syphilis is passed from an infected mother to her fetus

and produces a retinopathy. Active retinal lesions are rarely seen. However, upon dilation an optometrist may observe pallor of the optic disc, narrowing of the retinal vessels, and atrophy of the choroid or retina. Near the equator, clumps of pigment may be found giving rise to the so-called “salt and pepper” fundus of congenital syphilis. Again, these findings are not signs of active syphilis and no treatment is necessary. Secondary syphilis, on the other hand, may cause an acute iritis, chorioretinitis, or mild posterior uveitis. Systemic features include a maculopapular skin rash on the palms and soles, malaise, and fever. A patient with active ocular or systemic signs of syphilis should be referred to his primary care physician for systemic antibiotics.

Fungal and parasitic reactions are more difficult to diagnose. Fungal infections are often diagnosed based upon patient history. The patient will report working outside in his garden, raking leaves, or walking through the woods and getting poked in the eye with a tree branch. The conjunctiva is rarely affected in fungal infections. The cornea, on the other hand, will show a grayish-white lesion with indistinct margins and finger-like projections. It may have a gray halo and multiple satellite lesions. The overlying epithelium remains intact.

Chlamydia is an intracellular parasite whose signs and symptoms resemble both a viral and bacterial infection, making the diagnosis much more difficult. The red eye is often bilateral and causes either a watery or mucous discharge. The conjunctival reaction includes follicles or mild papillae. The preauricular lymph nodes may be swollen. The cornea may show an epithelial keratitis of the superior half or infiltrates. Upon questioning, the patient, usually a young adult, may admit to a new sexual partner or genitourinary involvement. At that time, not only should the patient’s eye be cultured but

the patient should be sent to his primary care physician for further testing to determine the exact cause of the symptoms and to receive proper treatment.

Acanthamoeba is a fresh water parasite found in tap water, lakes, and even chlorinated pools and hot tubs. Like fungal infections, Acanthamoeba mainly affects the cornea. In the past this organism most commonly caused infection in contact lens wearers who used distilled water and salt tablets instead of store-bought saline solutions for their lens care. Today most infections caused by Acanthamoeba are due to contact with hot tub or pool water. Acanthamoeba can be misdiagnosed for weeks because it can be confused with a viral or fungal infection. The infection is characterized by a breakdown of the corneal epithelium and a deep inflammation of the cornea. This often causes a ring-shaped ulcer or abscess near the center of the cornea. Patients will complain of severe pain. At the same time the optometrist finds only a small amount of inflammation.

In all of the above cases, laboratory cultures can be an important part of the treatment regimen. The culture can determine not only the cause of the red eye but also the drug to which the organism is most sensitive. Even if the culture comes back negative, this information is useful in ruling out a suspected cause. Either way the results are crucial, especially when treating a red eye caused by certain bacteria or viruses that are sight-threatening and do not respond to conventional therapy.

Another profession optometrists are getting more involved with is occupational therapy. Patients with progressive ocular diseases such as age-related macular degeneration or retinitis pigmentosa often need assistance relearning basic living skills or how to function on the job. Many of them do not realize that there are devices available to help them do just that. A patient with age-related macular degeneration loses his

central vision and must learn to eccentrically fixate while a patient with retinitis pigmentosa loses his peripheral vision and must learn to make large head movements in order to see off to the side. Each of these patients must concentrate on the vision that he still has and use this vision, as limited as it may be, to his advantage. In order to do this, he must allow the image to fall on the part of the retina that is still useful. Telescopes can be used for distance viewing, such as driving a car or watching television. Microscopes are used to improve a patient's ability to function at near, such as allowing the patient to read and write or even to do such a simple task as recognizing the food on his plate.

Telescopes and microscopes are not the only devices available, however. Closed Circuit Television (CCTV) is another magnifying device used for reading and other near tasks. It consists of a platform upon which the patient places his reading material and a screen where the magnified image appears. The CCTV allows the patient to read black print on a white background or vice versa. The device is focusable and the amount of magnification is adjustable. It also offers the advantage of a comfortable working distance. The main disadvantage is its expense. For some patients, something as simple as large print books or telephones with large numbers is sufficient and considerably less costly.

Keep in mind that all of these devices work not by making objects clearer but by magnifying the image and allowing it to fall on usable retina. In any case, optometrists can work with both the patient and his therapist to determine which low vision devices will best fit the patient's needs. The optometrist can then show the patient how to use the device to attain the skills he and his therapist are developing.

Veterinarians need to know about eyes in animals. Animals can get glaucoma or cataracts, just as humans can, and some ophthalmologists specialize in animals and do cataract surgery. Here are some things that veterinarians know about eyes. Dogs are color blind and only see various shades of gray. Cats have vertical pupils for easy up and down viewing. Horses have horizontal pupils to see sideways while grazing. Their eyes are twice the size of human's eyes. Fish do not have tear glands or eyelids since the water around them keeps their eyes moist. Camel's eyelashes are four inches long to protect them in sandstorms. Eagles have the best sight of all animals. Their eyes are also larger than human eyes and each one weighs more than its brain.

Patients should be aware of the many environmental factors that affect the eye. The sun and ultraviolet light can cause damage to many parts of the eye. Sun gazers run a high risk of macular burns which cause permanent vision loss. A pinguecula is a degeneration of collagen fibers of the conjunctiva and may enlarge, especially with exposure to wind and heat. This seldom requires treatment but may be cosmetically undesirable. Pterygia, however, frequently require surgical excision. These develop secondary to chronic dryness and ultraviolet exposure. They begin as a small corneal opacity near the limbus, which is then overgrown by conjunctiva. This lesion encroaches onto the cornea in a triangular fashion and may cause irregular astigmatism and distortions in vision.

Additionally, smoke and smoking can have adverse effects on the eyes. Smoky environments cause dry eyes and contact lens intolerance. Smoking is a risk factor in age related macular degeneration, which is at the present time untreatable. Smoking during

pregnancy contributes to low birth weight which may lead to ROP or other developmental problems.

Alcohol has an effect on the eye's functioning. When intoxicated, the eyes do not move as quickly or as smoothly as normal. Police officers are now trained to check for endpoint nystagmus, which is a jerky movement of the eyes when trying to look too far in one direction. Nystagmus occurs with less effort when under the influence of alcohol.

Some systemic medications have ocular side effects. Steroids cause posterior subcapsular cataracts (PSC) when used for an extended period of time. Antihistamines cause dry eyes. After prolonged administration of gold, patients with rheumatoid arthritis may develop deposits in the corneal stroma. Connective tissue disorders such as systemic lupus erythematosus are treated with chloroquine which causes bull's eye maculopathy. Medications should always be monitored by the patient's physician and optometrist for such signs and symptoms.

Trauma to the eye causes numerous complications. Patients must be monitored for many years following an accident. Blunt ocular injury may cause a rosette cataract to form immediately or several years later. A blow-out fracture, also a result of blunt trauma, occurs when the orbital floor has collapsed and extraocular muscles or orbital tissue become entrapped. The patient will present with a black eye and vertical diplopia. Surgical repair is necessary in this situation. A subconjunctival hemorrhage may occur following a strike to the eye or straining to lift something heavy. Fortunately, this condition will resolve in one to two weeks without treatment, as the hemorrhage is merely blood leaking from a superficial blood vessel.

A corneal foreign body is easily removed by an optometrist with the use of a spud, needle, or Alger brush. If the foreign body is centrally located on the cornea, scarring may cause permanent vision loss. If the foreign body is secondary to grinding metal, care must be taken to rule out an intraocular foreign body, since high speed metal projectiles may penetrate the eye without external scarring. Abrasions heal quickly and are treated with antibiotics, a pressure patch, or a bandage contact lens. Perforations, however, are ocular emergencies and must be dealt with immediately by an ophthalmologist. Protective eye wear can prevent many of these injuries.

New and improved techniques have popularized refractive surgery. The two most popular are radial keratotomy (RK) or photorefractive keratectomy (PRK). RK is performed by making radial incisions in the peripheral cornea in order to flatten the cornea and correct myopia. PRK involves removing the corneal epithelium and using an excimer laser to reshape the cornea, again correcting myopia. These techniques are used to correct distance vision. Patients should be aware that the results of these techniques vary and corrective lenses may still be necessary. In addition, these techniques generally do not correct for presbyopia.

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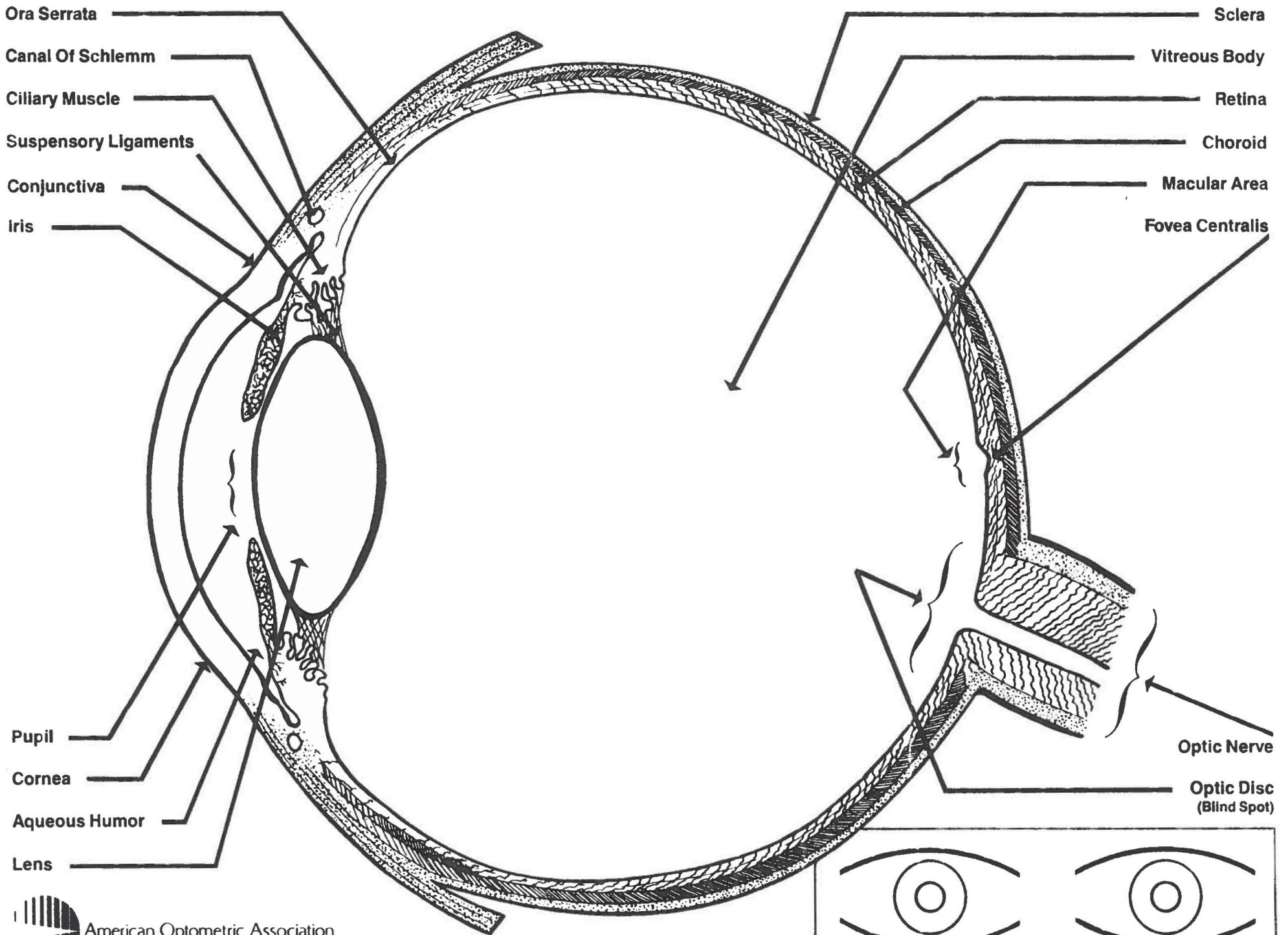
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Schematic Section of the Human Eye



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