

Overview

Do you or a family member have glaucoma? Do you wonder what this diagnosis means? If so, you are not alone. Glaucoma affects tens of millions of people worldwide. Despite its prevalence, many people lack accurate information about this disease. Therefore, the goal of this course is to provide glaucoma-related information that helps you take an active role in adjusting to life with glaucoma.

This course includes five lessons. Lesson 1 discusses the human eye and forms of glaucoma. Lesson 2 explains how a doctor diagnoses glaucoma. Lesson 3 describes common treatments for this disease. Lesson 4 discusses the emotional impact of visual impairment. And finally, Lesson 5 explains ways to continue daily activities when vision loss occurs. The material in this course is informational only; it constitutes neither the advice of a medical doctor nor that of a rehabilitation specialist. These professionals are best qualified to diagnose and treat glaucoma and any resulting visual impairment.

For your convenience, some lessons begin with a section called “Key Terms,” which introduces words that may be unfamiliar. Each lesson also includes section reviews, which are for your personal development only. Therefore, when you complete a section review, do not send your responses to your Hadley instructor. Rather, check your comprehension by comparing your answers with those provided. You can always contact your instructor, however, to clarify concepts.

You are required to submit five assignments, one at the end of each lesson. To personalize the course, some assignment questions ask you to apply material in a lesson to you or your family member. In responding to such questions, include only information that you are comfortable revealing. Moreover, if applicable, to respect your relative’s privacy, do not identify him or her by full name in any assignment.

Now, if you are ready to learn about glaucoma, begin Lesson 1: What Is Glaucoma?

Lesson 2: Diagnosing Glaucoma

Lesson 1 discussed the human eye and forms of glaucoma. How does a doctor diagnose glaucoma? Lesson 2 describes eye doctors and a routine eye exam. This lesson also discusses three tests specially designed to detect glaucoma. Learning about the diagnosis of glaucoma helps you take an active role in adjusting to life with glaucoma.

Objectives

After completing this lesson, you will be able to

- a. define the role of eye doctors
- b. describe a routine eye exam
- c. describe additional eye tests for glaucoma

Key Terms

The following terms appear in this lesson. Familiarize yourself with their meanings so that you can use them in your course work.

age-related macular degeneration (AMD): a

degenerative eye disease that causes damage to the center of the retina

air puff test: test that measures IOP as the resistance of the cornea to a puff of air; type of tonometry

applanation tonometry: test that measures IOP as the weight necessary to flatten the cornea

gonioscopy: test in which a doctor examines the drainage angle in the eye, using a contact lens that contains a mirror

ophthalmologist: medical and surgical doctor, or physician, who has an M.D. degree and who specializes in eye and vision care

ophthalmoscopy: dilated eye test in which a doctor uses a device called an ophthalmoscope to look through the pupil at the optic nerve and retina

optometrist: Doctor of Optometry (O.D.) who completes post-graduate-level work in eye and vision care

pachymetry: test that uses an ultrasonic wave to measure the thickness of the cornea

perimetry: See "visual field test."

tonometry: test that measures IOP; types include the air puff test, applanation tonometry, and an electronic version

visual acuity test: eye chart test that measures how well a person can see at various distances

visual field test: also known as perimetry; test that evaluates a person's field of vision based on the flashes of light he or she perceives

Eye Doctors

This section describes the difference between an ophthalmologist and an optometrist, as well as who needs to visit an eye doctor and how to find one. What makes a good doctor-patient relationship, and what to expect when a doctor takes your medical history is also covered.

The term *eye doctor* usually refers to an ophthalmologist or an optometrist. The former is a medical and surgical doctor, or physician, who specializes in eye and vision care. Ophthalmologists have completed medical school and have received an M.D. degree. They are trained to test vision, prescribe glasses and contact lenses, diagnose eye diseases, and perform or prescribe treatment, including surgical and laser treatment.

An optometrist, or Doctor of Optometry (O.D.), has completed post-graduate-level work. Optometrists, however, are not physicians. Optometrists can test vision, prescribe glasses or contact lenses, and use vision therapy. Optometrists can also diagnose eye diseases. In some cases, they prescribe medication and perform minor surgery. Both ophthalmologists and optometrists can prescribe low vision aids, which are discussed in Lesson 5. If necessary, an eye doctor may refer an individual to a glaucoma specialist.

Who needs to visit an eye doctor? If you have any of the symptoms mentioned in Lesson 1, make an appointment immediately. The same holds true for any other eye problems you experience. Also, glaucoma is an ongoing and potentially progressive condition.

Therefore, people with glaucoma should have regularly scheduled eye exams. Recall that family history is a risk factor for glaucoma. Therefore, if you have a relative with this disease, have a doctor check your eyes. You may also want to suggest this to other family members.

For people with no eye problems and no risk factors for eye disease, experts recommend an eye exam every three to five years until age 50. Because many eye problems and eye diseases are age-related, it makes sense for people over age 50 to visit an eye doctor at least once a year.

You may already have a trusted eye doctor. If not, seek referrals from reliable sources: Identify doctors covered by your insurance. Ask for recommendations from your primary care physician, friends, or family members. Or contact a vision-related organization. For example, if you live in the United States, the American Academy of Ophthalmology and American Optometric Association have an eye doctor locator on their Web sites.

What makes a good eye doctor? Surveys indicate that people want a doctor whom they can relate to. Each person determines this individually. Moreover, people want a doctor who is well qualified and who shows compassion. A doctor referred by someone usually provides experienced care. Or ask the doctor for a brief biography. You may also want to ask about his or her experience in regard to glaucoma. In terms of

compassion, a good doctor speaks frankly with you about health issues. He or she protects your privacy and educates you about your eyes. A good doctor also speaks to you as an equal. If your doctor lacks these qualities, however, exercise your right to find a new one.

Mutual respect is an important part of a good doctor-patient relationship. Therefore, plan to be on time for appointments. If necessary, arrange for transportation in advance. An eye doctor usually dilates your eyes during an exam, causing them to be blurry. Therefore, you will most likely be unable to drive afterward; plan accordingly. If you have to cancel an appointment, try to give 24-hour notice. Of course, sometimes, you may have a good reason for canceling at the last minute, such as an illness.

Also, doctors often attend to medical emergencies, which push back their schedules. Be patient. If the wait becomes very long, however, you have a right to tell the receptionist that you are leaving. If a doctor always keeps you waiting, consider finding a new one.

Patients involved in their own medical care generally have better outcomes. Take an active role by making a list of questions for your doctor. If you are at the doctor for a glaucoma screening, you may ask, what tests will I undergo? What will you check for? Having this information may also help put you at ease. If you have already been diagnosed with glaucoma, you may ask, what type of glaucoma do I have? What informational material can you give me on this disease? Do you recommend a glaucoma specialist? If you do not have glaucoma, but you have one or more risk factors, ask your doctor what warning signs might indicate glaucoma. Then be on the lookout for any.

A doctor will also ask you questions about your health, or take your medical history. The eye doctor or a staff member will ask you to respond to verbal questions or to fill out a form, or both. Typical questions include the following:

- How old are you?
- What medications, including eye drops, are you currently taking?
- Are you allergic to any medications?
- Do you have any medical conditions?

- Have you ever had surgery or sustained an injury?
- How is your vision?
- Do you wear glasses, and if so, do they work?
- What is your eyeglass or contact lens prescription?
- Has anyone in your family had eye trouble or eye disease, such as glaucoma?

Your answers to these questions help the doctor determine if you are at risk for eye disease. They also help inform what tests the doctor will administer and what treatment plan, if necessary, he or she will prescribe.

When scheduling an appointment, you may request that any forms be sent to you in the mail. This way, you can collect information, and respond to the questions in advance. Also bring along to the appointment any current glasses or contact lens prescriptions.

Section Review

Review the information in this section by briefly responding to the following questions. Then, compare your answers with those provided.

1. Who needs to visit an eye doctor?

A person needs to visit an eye doctor when he or she has any of the following: symptoms of glaucoma, a diagnosis of glaucoma, a family history of glaucoma, or other eye problems. Moreover, scheduling regular eye exams is important for everyone.

2. How often should individuals visit an eye doctor?

For people with no eye problems and no risk factors for eye disease, experts recommend an eye exam every three to five years until age 50 and at least once a year over age 50.

3. According to surveys, what three qualities make a good doctor?

According to surveys, a good doctor is someone whom people can relate to. People also want a doctor who is well qualified and who shows compassion.

4. Which patients generally have better outcomes?

Patients involved in their medical care generally have better outcomes. One way they take an active role is by asking questions about medical testing, their diagnosis, and so on.

5. Why does an eye doctor take a person's medical history?

An eye doctor takes a person's medical history to determine if the individual is at risk for eye disease. Moreover, the answers provided by the patient help determine what tests the doctor will perform and what treatment plan the doctor will prescribe, if necessary.

This section described the difference between an ophthalmologist and an optometrist. It also discussed who needs to visit an eye doctor and how to find one. Finally, this section explained what makes a good doctor-patient relationship, as well as what to expect when a doctor takes your medical history.

Routine Eye Exam

After a doctor takes your medical history, he or she will perform a routine eye exam, or a series of tests that assess vision and check for eye diseases. It typically includes the following:

- visual acuity tests
(to determine how well a person sees)
- external eye exam
- internal eye exam
- IOP measurement
- dilated eye exam

A doctor may perform some or all of these tests, depending on a person's medical profile. It is also worth noting that a diagnosis of glaucoma most often follows a routine eye exam.

Visual Acuity Tests

Eye doctors measure distance visual acuity and near visual acuity. *Visual acuity* refers to how clearly, or how well, a person can see. To test distance visual acuity, most doctors use the Snellen eye chart, which has a big letter *E* at the top. Rows of letters follow the *E*, becoming gradually smaller. A person reads aloud

from the chart, usually at a distance of 20 feet (6 m). The further down the chart a person can identify letters, the better his or her distance vision.

Distance visual acuity is expressed as a fraction. As you may know, 20/20 (6/6 metric) indicates healthy vision. The top number is the distance from which a person reads the eye chart. The bottom number is the distance at which a person with healthy eyesight reads a certain line on the eye chart. For example, a person with a visual acuity of 20/200 (6/60 metric) sees clearly at 20 feet (6 m) what a person with healthy vision sees clearly at 200 feet (60 m). The fraction 20/200 (6/60 metric) also corresponds to a row on the eye chart, the smallest one the person in this example is able to read.

Other tests for distance visual acuity exist, including the Tumbling E chart. This chart has the capital letter *E* facing different directions. The person being tested indicates whether the *E* is pointing up, down, left, or right. Other charts consist of pictures for children or for those who cannot read the alphabet.

If a person has trouble reading, or focusing the eyes, a doctor also tests near visual acuity, or close vision. The person reads aloud from a handheld chart at a distance of 14 to 16 inches (36 to 41 cm). This chart has lines of words that become gradually smaller. Again, how far down on the chart a person can read determines visual acuity—this time for close vision. A doctor uses the results of the visual acuity tests to determine whether a person needs glasses. Then, those who need them undergo more tests to find the right prescription.

External and Internal Eye Exams

Moreover, a doctor examines the outside and inside of the eyes. On the outside, he or she notes the shape of the pupils and how they react to light. To evaluate the eye muscles, a doctor has the patient move his or her eyes in different directions. A doctor also inspects the eyelids and lashes. He or she looks inside the eyes using a slit lamp, or microscope. A slit lamp magnifies and illuminates the anterior chamber, including the cornea, iris, and lens. The following photograph shows an eye care professional using a slit lamp to look inside a boy's eye.



Description: Eye care professional and patient at slit lamp

Credit: National Eye Institute, National Institutes of Health

Reference: EE49

During these various observations, a doctor further investigates anything unusual.

IOP Measurement

A doctor performs tests that screen for certain eye diseases. He or she measures IOP, which when elevated may indicate glaucoma. *Tonometry* refers to a test that measures IOP. Two common forms are the air puff test and applanation tonometry. With the air puff

test, the patient stares into a device, which releases a puff of air at the eye. The device measures IOP as the resistance of the cornea to the puff of air. This procedure is quick and painless and requires no anesthesia. The puff of air, however, may be startling.

Applanation tonometry is currently the most accurate method for measuring IOP. A doctor first applies numbing eye drops with a yellow dye. The dye, along with a blue light, helps the doctor to see the cornea. The light also helps the doctor to read the measuring device or probe. During the procedure, he or she gently applies the probe against the eye. It measures IOP as the weight necessary to flatten the cornea.

Sometimes, a doctor uses an electronic tonometer. This object is similar in shape to a pen. A doctor first numbs the eye, and then, touches the tip of the tonometer to the cornea. The device registers a digital measurement of IOP. Because elevated IOP is a risk factor for glaucoma, a doctor will investigate further any unusually high readings. This holds true regardless of the tonometry test used.

Dilated Eye Exam

This exam, or ophthalmoscopy, screens for glaucoma, among other eye diseases. With this test, a doctor gives the patient eye drops to dilate, or widen, the pupil. The enlarged opening allows the doctor a better view of the back of the eye. Using a device called an ophthalmoscope, the doctor looks through the pupil to the retina and optic nerve. The device may be handheld or mounted on the doctor's forehead. Like a slit lamp, it illuminates and magnifies the inner eye. The following photograph shows an eye care professional using an ophthalmoscope to examine the back of a man's eye.



Description: Ophthalmoscopy

Credit: National Eye Institute, National Institutes of Health

Reference: EE30

A doctor evaluates the shape and color of the optic nerve, noting any damage. In a healthy eye, the optic disk is pink or red. With glaucoma, it often appears pale or white. Also, recall from Lesson 1 the effect known as cupping. As nerve fibers die, the rim of the optic disk gets thinner, and its central cup gets wider. Therefore, a large cup-to-disk ratio may indicate glaucoma.

During the dilated eye exam, a doctor also evaluates the retina. Damage to this structure may indicate disease, such as age-related macular degeneration (AMD). If a doctor suspects AMD, he or she will perform another test called the Amsler grid. This grid helps a doctor to evaluate central, or straight ahead, vision, which AMD affects. If you are interested in learning more about AMD, consider taking the Hadley course “Macular Degeneration.”

The eye drops used in ophthalmoscopy cause blurry vision that lasts for several hours. Therefore, dark sunglasses are indicated if going into bright sunlight. Since driving is often not possible after this test, arrange for transportation ahead of time. Options include taking a bus, train, or taxi or getting a ride from someone.

Section Review

Review the information in this section by answering the following true/false and multiple-choice questions. Then, compare your answers with those provided.

True/False

Indicate whether the following statements are true or false. If the statement is false, reword it to make it true.

1. During an external eye exam, the eye doctor inspects the pupils, eye muscles, eyelids, and lashes.

True

2. Applanation tonometry is currently the most accurate method for measuring IOP.

True

3. In a healthy eye, the optic disk is pale or white.

False. In a healthy eye, the optic disk is pink or red, whereas in an eye with glaucoma, the optic disk is often pale or white.

4. A small cup-to-disk ratio may indicate glaucoma.

False. A large cup-to-disk ratio is more suggestive of glaucoma.

Multiple Choice

Choose the best answer for each item.

5. Which test does an eye doctor use to measure distance visual acuity?
- a. Snellen eye chart
 - b. external eye exam
 - c. internal eye exam
 - d. ophthalmoscopy

The correct answer is (a). An eye doctor uses the Snellen eye chart to measure distance visual acuity.

6. During which test does an eye doctor use a slit lamp to magnify and illuminate the anterior chamber of the eye?
- a. internal eye exam
 - b. dilated eye exam
 - c. external eye exam
 - d. Tumbling E chart

The correct answer is (a). During the internal eye exam, an eye doctor uses a slit lamp to magnify and illuminate the anterior chamber of the eye.

7. Which test does an eye doctor use to measure IOP?

- a. external eye exam
- b. internal eye exam
- c. air puff test
- d. ophthalmoscopy

The correct answer is (c). An eye doctor uses the air puff test to measure IOP.

8. During which test does an eye doctor examine the retina and the optic nerve?

- a. air puff test
- b. Tumbling E chart
- c. dilated eye test
- d. external eye exam

The correct answer is (c). During the dilated eye test, an eye doctor examines the retina and the optic nerve.

This section described a routine eye exam, which typically includes the following tests:

- distance visual acuity test
- near visual acuity test

- external eye exam
- internal eye exam
- tonometry (measurement of IOP)
- ophthalmoscopy (dilated eye exam)

These tests help a doctor assess vision and check for eye diseases.

Additional Tests

An eye doctor suspects glaucoma when IOP is not within the normal range or when the optic nerve looks unusual, or both. In these cases, a doctor may perform one or more additional tests for glaucoma, which include perimetry, gonioscopy, and pachymetry.

Perimetry

Perimetry, or the visual field test, helps evaluate a person's peripheral vision and some of his or her central vision. Peripheral vision includes the top, bottom, and sides of vision. Recall that with glaucoma, damage to the optic nerve causes loss of peripheral vision. Perimetry allows the doctor to check whether this type of loss has occurred, and if so, to what extent.

Perimetry may be computerized or manual. With the former, a person looks into a screen and presses a button each time he or she perceives a flash of light. The computer produces the flashes of light. It also records the location of each flash and whether the person pressed the button when a flash appeared. Then, at the end of the test, the computer uses this information to print a map of the person's visual field.

On a computerized visual field map, the white areas indicate healthy vision. Light grey areas indicate mild visual field defects, whereas black areas indicate severe ones. Visual field defects refer to blind spots, which correspond to undetected flashes of light and to damage in the optic nerve.

The manual version of this test is called the Goldmann perimeter. It differs from the computerized version in that a technician produces the flashes of light and records the responses. Because of the increased potential for human error, this test is generally considered less accurate. Therefore, as technology becomes more widespread, doctors use this version of the test less often.

With the results of a visual field test, a doctor can assess the extent of damage, if any, from glaucoma. Moreover, a doctor may periodically repeat this test for a person who has glaucoma, checking for any change in condition.

Gonioscopy

A doctor uses this test to examine the drainage angle in the eye. He or she numbs the eye with topical anesthesia, and then, places a gonioscope, or lens that contains a mirror, on the cornea. This mirror, along with a slit lamp, makes visible the drainage angle. A doctor can then check for the presence of open- or closed-angle glaucoma, by noting the width of the angle and any visible obstructions. A doctor may periodically repeat this test for a person who has glaucoma, checking for any change in condition.

Pachymetry

Besides helping to diagnose glaucoma, this test also helps assess any risk a person may have of developing glaucoma. To start, a doctor numbs the eyes with topical anesthesia, and then, applies a handheld device to the cornea. This device uses an ultrasonic wave to

measure the thickness of the cornea. This test is important for two reasons. First, in patients with elevated IOP, corneal thinness is a strong factor in predicting the development of POAG. Second, in people with thick corneas, measures of IOP tend to be overstated, whereas in people with thin corneas, measures of IOP tend to be understated. A doctor considers this information in evaluating a person's eyes. Additionally, a doctor may periodically repeat this test for a person who has glaucoma, checking for any change in condition.

Section Review

Review the information in this section by answering the following true/false and multiple-choice questions. Then, compare your answers with those provided.

True/False

Indicate whether the following statements are true or false. If the statement is false, reword it to make it true.

1. Perimetry helps evaluate a person's central vision.

False. Perimetry helps evaluate a person's peripheral vision, as well as some of his or her central vision.

2. On a computerized visual field map, the white areas indicate healthy vision.

True

3. In patients with elevated IOP, corneal thinness is a strong factor in predicting the development of POAG.

True

4. In people with thick corneas, measures of IOP tend to be understated.

False. In people with thick corneas, measures of IOP tend to be overstated, whereas in people with thin corneas, measures of IOP tend to be understated.

Multiple Choice

Choose the best answer for each item.

5. Which test helps locate blind spots in the field of vision?

- a. air puff test
- b. perimetry
- c. gonioscopy
- d. pachymetry

The correct answer is (b). The test perimetry locates blind spots in the field of vision.

6. During which test does an eye doctor examine the drainage angle in the eye?

- a. air puff test
- b. perimetry
- c. gonioscopy
- d. pachymetry

The correct answer is (c). During the test gonioscopy, an eye doctor examines the drainage angle in the eye.

7. What is a gonioscope?
- a. a lens that contains a mirror
 - b. an external eye exam
 - c. a visual field map
 - d. an ultrasonic wave

The correct answer is (a). A gonioscope is a lens that contains a mirror.

8. Which test measures the thickness of the cornea?
- a. air puff test
 - b. perimetry
 - c. gonioscopy
 - d. pachymetry

The correct answer is (d). The test pachymetry measures the thickness of the cornea.

This section described perimetry, gonioscopy, and pachymetry. A doctor performs one or more of these tests to help diagnose glaucoma.

Summary

After discussing eye doctors, this lesson described the tests involved in a routine eye exam, which include the following:

- distance visual acuity test
- near visual acuity test
- external eye exam
- internal eye exam
- tonometry (measurement of IOP)
- ophthalmoscopy (dilated eye exam)

These tests help a doctor assess vision and check for eye diseases.

If a doctor suspects that a person has glaucoma, he or she will perform one or more additional tests:

- perimetry (visual field test)
- gonioscopy (evaluation of drainage angle)
- pachymetry (measurement of cornea thickness)

Assignment 2

For general instructions on completing assignments, refer to the Welcome Letter. Then start this assignment by giving your full name, address, and phone number. Also list the name of this course, Assignment 2, your instructor's name, and the date. Be sure to include the question number along with each answer.

Short Answer

Answer each of the following items in a brief paragraph or list:

1. Define *ophthalmologist* and *optometrist*.
2. List two people who may refer you to an eye doctor.
3. In regard to health, list five questions that either an eye doctor may ask a patient or a patient may ask an eye doctor.
4. What are the two goals of a routine eye exam?
5. List the tests that are part of a routine eye exam.
6. Define *applanation tonometry* using at least three details in your definition.

7. Under what circumstances does an eye doctor suspect a person has glaucoma?
8. Beyond a routine eye exam, what tests for glaucoma may an eye doctor perform?
9. Describe one of the tests from Question 8 using at least four details.

Essay

Respond to the following question with a brief, complete answer.

10. In receiving a diagnosis of glaucoma, how was your own or your family member's experience similar to or different from the description in this lesson? Include the following information in your answer:

- your feelings when you first heard the diagnosis
- physical symptoms before and after the diagnosis
- your or your family member's age at the time of diagnosis
- the treatment suggested

- any other information that you feel is important to share

When you have completed this assignment, proceed to Lesson 3: Treating Glaucoma.