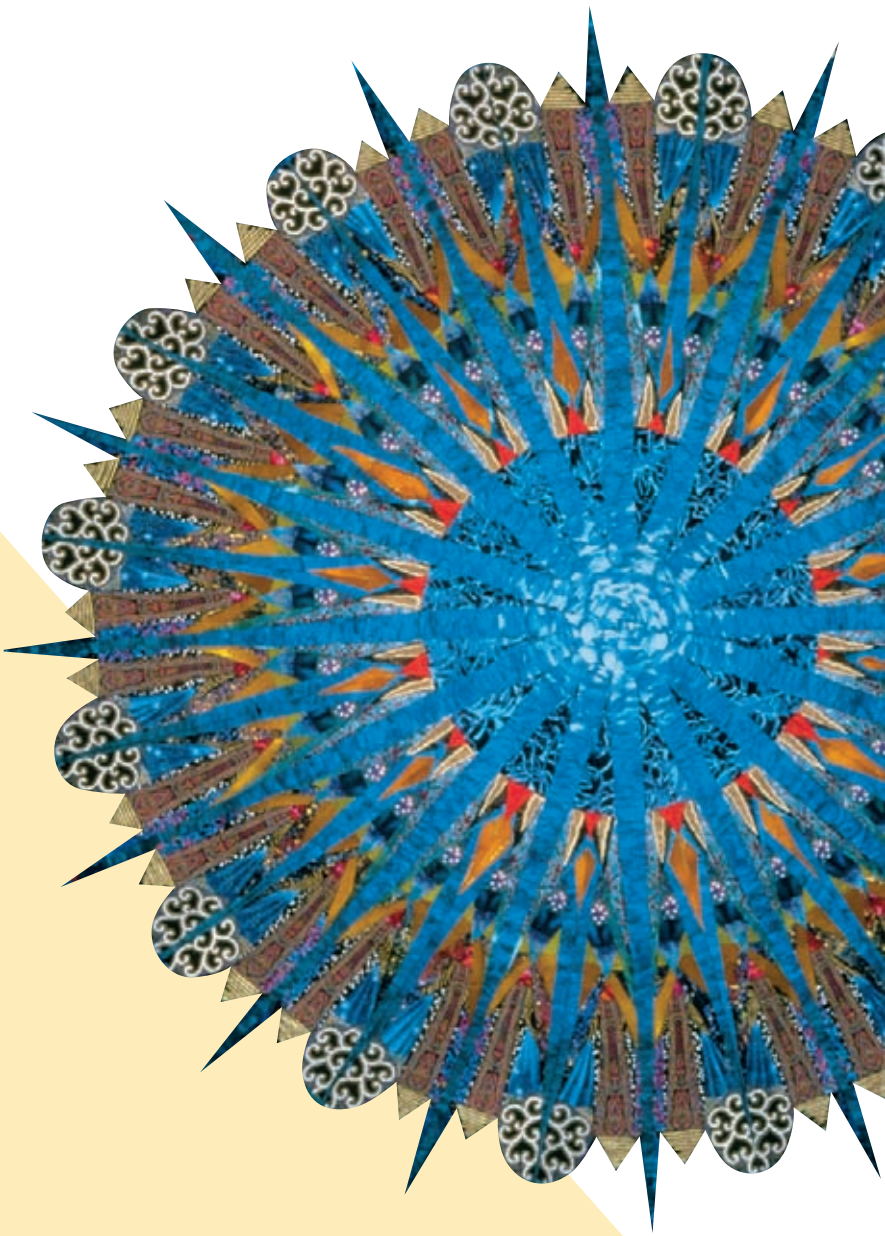
UNIT 14 Responses to Altered Visual and Auditory Function



CHAPTER 47
Assessing Clients with Eye and Ear Disorders

CHAPTER 48
Nursing Care of Clients with Eye and Ear Disorders

CHAPTER 47 Assessing Clients with Eye and Ear Disorders

LEARNING OUTCOMES

- Describe the anatomy, physiology, and functions of the eye and the ear.
- Explain the physiologic processes involved in vision, hearing, and equilibrium.
- Identify specific topics for consideration during a health history interview of the client with health problems of the eye or ear.
- Describe normal variations in assessment findings for the older adult.
- Identify abnormal findings that may indicate impairment in the function of the eye and the ear.

CLINICAL COMPETENCIES

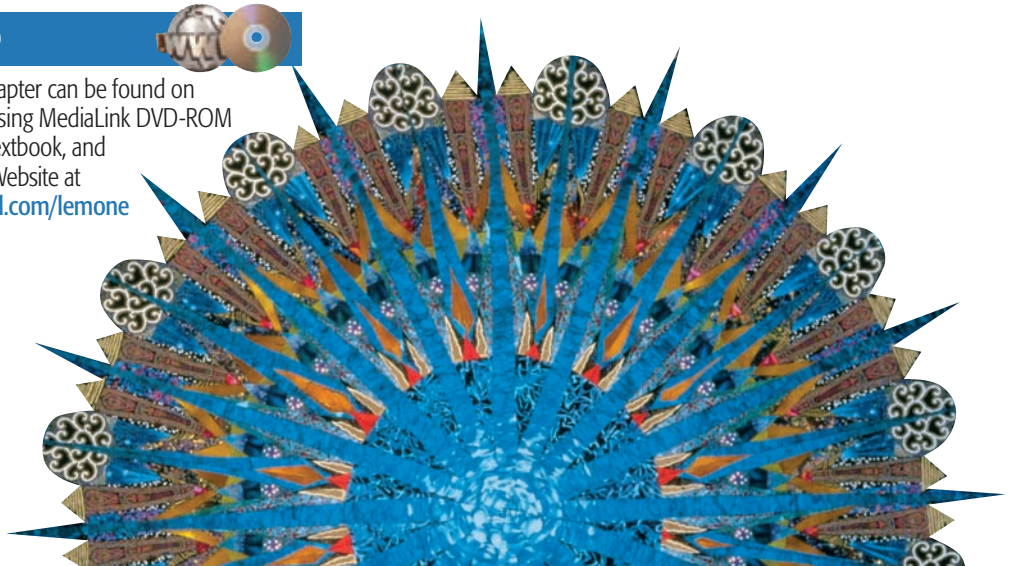
- Conduct and document a health history for clients having or at risk for alterations in the structure or functions of the eye and ear.
- Monitor the results of diagnostic tests and report abnormal findings.
- Conduct and document a physical assessment of the structure or functions of the eye and ear.

EQUIPMENT NEEDED

- Visual acuity charts
- Opaque eye cover
- Pen
- Penlight
- Cotton-tipped applicator
- Ophthalmoscope
- Otoscope
- Tuning fork

MEDIALINK

Resources for this chapter can be found on the Prentice Hall Nursing MediaLink DVD-ROM accompanying this textbook, and on the Companion Website at http://www.prenhall.com/lemone



KEY TERMS

accommodation, *1673*
cerumen, *1682*
convergence, *1673*
corneal reflex, *1671*
hyperopia, *1677*
myopia, *1677*
nystagmus, *1677*
presbyopia, *1677*
ptosis, *1679*
pupillary light reflex, *1671*
refraction, *1673*

Vision and hearing allow us to experience the world in which we live. The eyes and ears provide pathways for visual and auditory stimuli to reach the brain. In addition, specialized structures within the ear help maintain position sense and equilibrium. Deficits in vision and hearing may limit self-care, mobility, safety, independence, communication, and relationships with others.

ANATOMY, PHYSIOLOGY, AND FUNCTIONS OF THE EYES

The eyes are complex structures, containing 70% of the sensory receptors of the body. Both extraocular and intraocular structures are considered parts of the eye.

Each eye is a sphere measuring about 1 inch (2.5 cm) in diameter, surrounded and protected by a bony orbit and cushions of fat. The primary functions of the eye are to encode the patterns of light from the environment through photoreceptors and to carry the coded information from the eyes to the brain. The brain gives meaning to the coded information, allowing us to make sense of what we see.

Extraocular Structures

Although the extraocular structures of the eye are outside the eyeball, they are vital to its protection. These structures are the eyebrows, eyelids, eyelashes, conjunctiva, lacrimal apparatus, and extrinsic eye muscles (Figure 47–1 ■).

The eyebrows shade the eyes and keep perspiration away from them. The eyelids are thin, loose folds of skin covering the anterior eye. They protect the eye from foreign bodies, regulate the entry of light into the eye, and distribute tears by blinking. The eyelashes are short hairs that project from the top and bottom borders of the eyelids. An unexpected touch to the eyelashes initiates the blinking reflex to protect the eyes from foreign objects.

The conjunctiva is a thin, transparent membrane that lines the inner surfaces of the eyelids and also folds over the anterior surface of the eyeball. The palpebral conjunctiva lines the upper and lower eyelids, whereas the bulbar conjunctiva loosely covers the anterior sclera (the white part of the eye). The conjunctiva is a mucous membrane that lubricates the eyes. The lacrimal apparatus is composed of the lacrimal gland, the puncta, the lacrimal sac, and the nasolacrimal duct. Together, these structures secrete, distribute, and drain tears to cleanse and moisten the eye's surface.

The six extrinsic eye muscles control movement of the eye, allowing it to follow a moving object and move precisely. The muscles also help maintain the shape of the eyeball. The cranial nerves control the extrinsic muscles (Figure 47–2 ■).

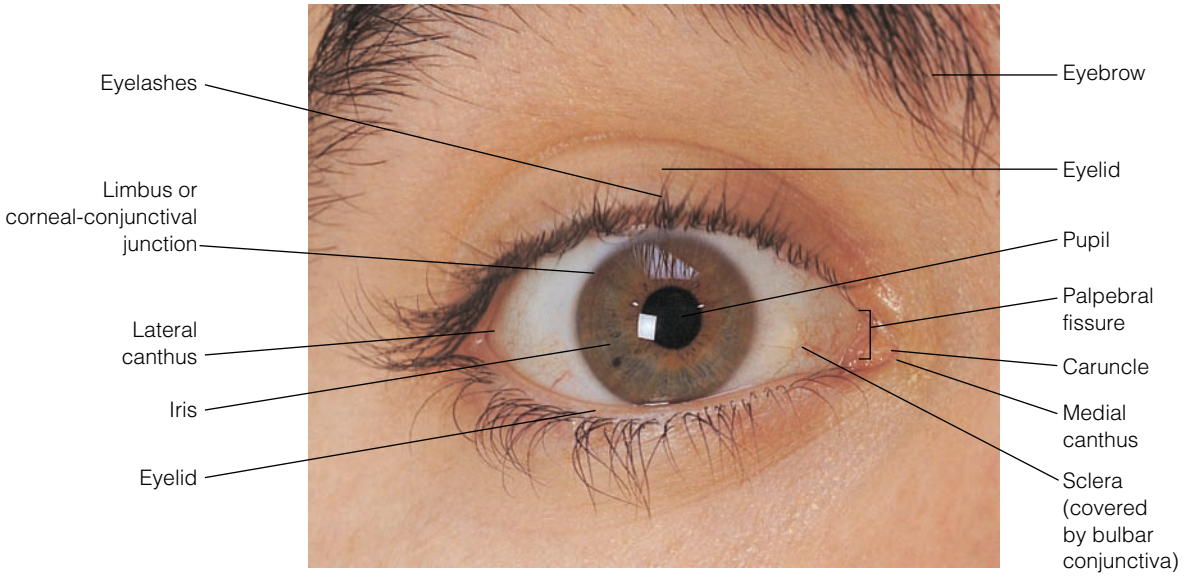
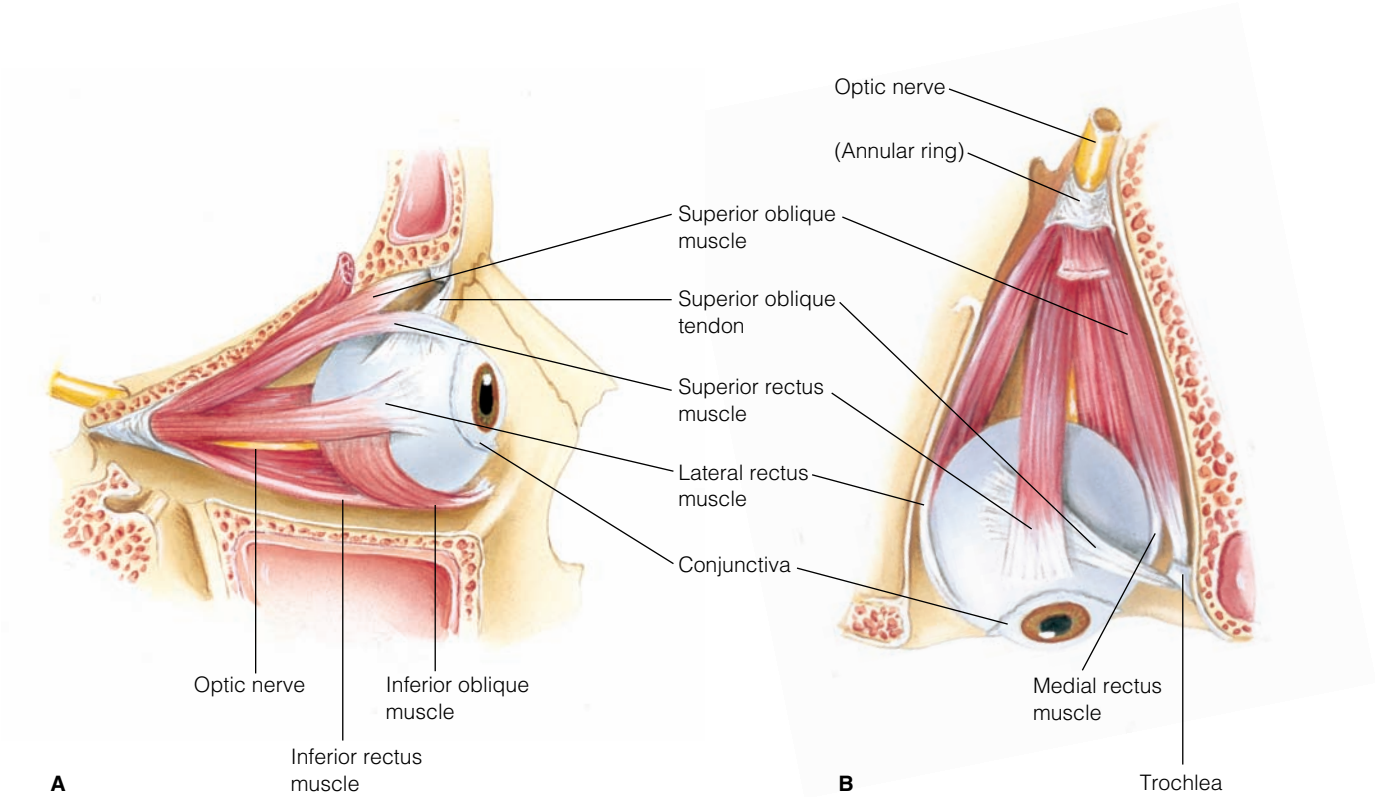


Figure 47–1 ■ Accessory and external structures of the eye.
Source: Todd Buck.



C

Name	Controlling cranial nerve	Action
Lateral rectus	VI (abducens)	Moves eye laterally
Medial rectus	III (oculomotor)	Moves eye medially
Superior rectus	III (oculomotor)	Elevates eye or rolls it superiorly
Inferior rectus	III (oculomotor)	Depresses eye or rolls it inferiorly
Inferior oblique	III (oculomotor)	Elevates eye and turns it laterally
Superior oblique	IV (trochlear)	Depresses eye and turns it laterally

Figure 47–2 ■ Extraocular muscles. *A*, Lateral view of the right eye. *B*, Superior view of the right eye. *C*, Innervation of the extraocular muscles by the cranial nerves.

Intraocular Structures

The intraocular structures transmit visual images and maintain homeostasis of the inner eye. Those in the anterior portion of each eyeball are the sclera and the cornea (forming the outermost coat of the eye, called the fibrous tunic), the iris, the pupil, and the anterior cavity (Figure 47–3 ■).

Sclera and Cornea

The white sclera lines the outside of the eyeball, and protects and gives shape to the eyeball. The sclera gives way to the cornea over the iris and pupil. The cornea is transparent, avascular, and sensitive to touch. The cornea forms a window that allows light to enter the eye and is a part of its light-bending apparatus. When the cornea is touched, the eyelids blink (**corneal reflex**) and tears are secreted.

Iris

The iris is a disc of muscle surrounding the pupil and lying between the cornea and the lens. The iris gives the eye its color and regulates light entry by controlling the size of the pupil. The pupil is the dark center of the eye through which light enters. The pupil constricts when bright light enters the eye and when it is used for near vision; it dilates when light conditions are dim and when the eye is used for far vision. In response to intense light, the pupil constricts rapidly in the **pupillary light reflex**.

Aqueous Fluid

The anterior cavity is made of the anterior chamber (the space between the cornea and the iris) and the posterior chamber (the space between the iris and the lens). The anterior cavity is filled with aqueous humor. Aqueous humor, a clear fluid, is constantly

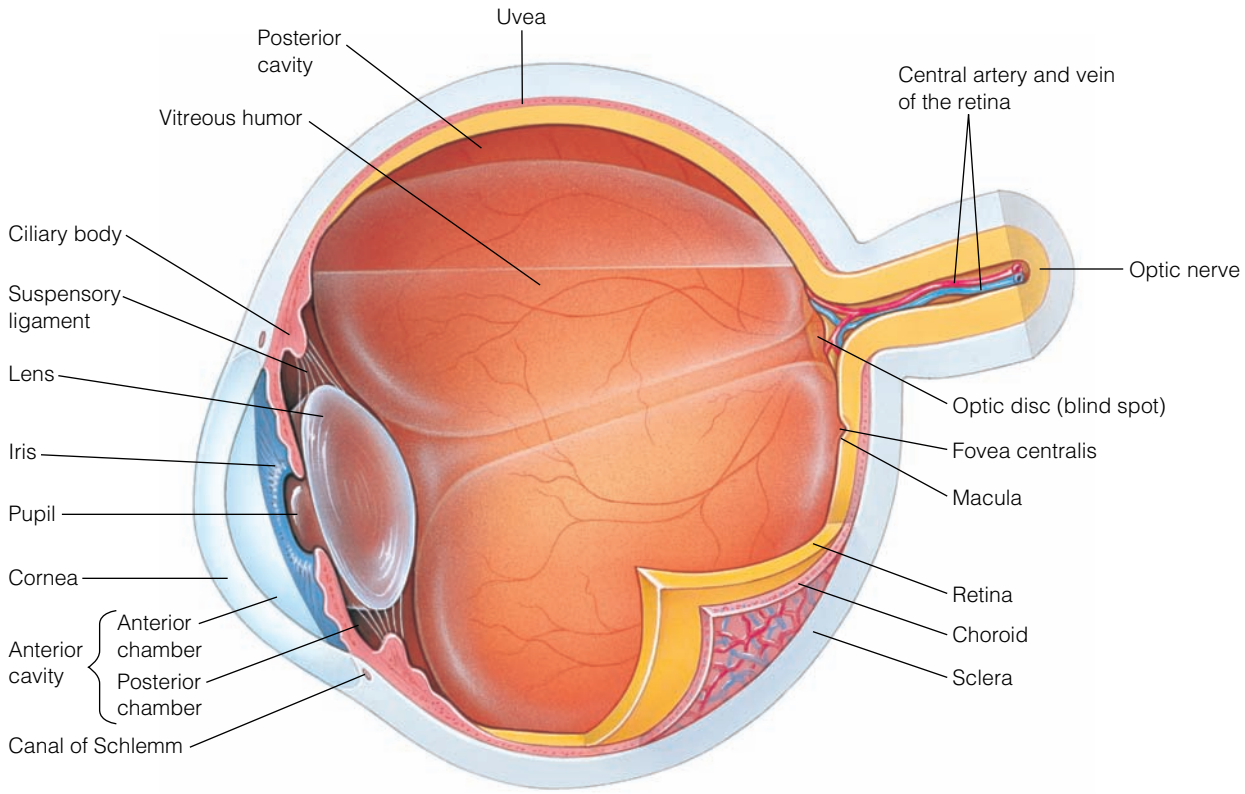


Figure 47–3 ■ Internal structures of the eye.

formed and drained to maintain a relatively constant pressure of from 15 to 20 mmHg in the eye. The canal of Schlemm, a network of channels that circles the eye in the angle at the junction of the sclera and the cornea, is the drainage system for fluid moving between the anterior and posterior chambers. Aqueous humor provides nutrients and oxygen to the cornea and the lens.

Internal Chamber

The intraocular structures that lie in the internal chamber of the eye are the lens, the posterior cavity and vitreous humor, the ciliary body, the uvea, and the retina.

The lens is a biconvex, avascular, transparent structure located directly behind the pupil. It can change shape to focus and refract light onto the retina. The posterior cavity lies behind the lens. It is filled with a clear gelatinous substance, the vitreous humor, which supports the posterior surface of the lens, maintains the position of the retina, and transmits light. The uvea, also called the vascular tunic, is the middle layer of the eyeball. This pigmented layer has three components: the iris, ciliary body, and choroid. The ciliary body encircles the lens, and along with the iris, regulates the amount of light reaching the retina by controlling the shape of the lens. Most of the uvea is made up of the choroid, which is pigmented and vascular. Blood vessels of the choroid nourish the layers of the eyeball. Its pigmented areas absorb light, preventing it from scattering within the eyeball.

The retina is the innermost lining of the eyeball. It has an outer pigmented layer and an inner neural layer. The outer layer, next to the choroid, serves as the link between visual stimuli and the brain. The transparent inner layer is made up of millions of light receptors in structures called rods and cones. Rods enable vision in dim light as well as peripheral vision. Cones enable vision in bright light and the perception of color. The optic disc, a cream-colored round or oval area within the retina, is the point at which the optic nerve enters the eye. The slight depression in the center of the optic disc is called the physiologic cup. Located laterally to the optic disc is the macula, a darker area with no visible blood vessels. The macula contains primarily cones. The fovea centralis is a slight depression in the center of the macula that contains only cones and is a main receptor of detailed color vision.

The Visual Pathway

The optic nerves are cranial nerves formed of the axons of ganglion cells. The two optic nerves meet at the optic chiasma, just anterior to the pituitary gland in the brain. At the optic chiasma, axons from the medial half of each retina cross to the opposite side to form pairs of axons from each eye. These pairs continue as the left and right optic tracts (Figure 47–4 ■). The crossing of the axons results in each optic tract carrying information from both eyes. The left optic tract carries visual information from the lateral half of the retina of the left eye and the medial half of the retina of the right eye, whereas the right optic tract carries visual information from the lateral half of the retina of the right eye and the medial half of the retina of the left eye.

The ganglion cell axons in the optic tracts travel to the thalamus and synapse with neurons, forming pathways called op-

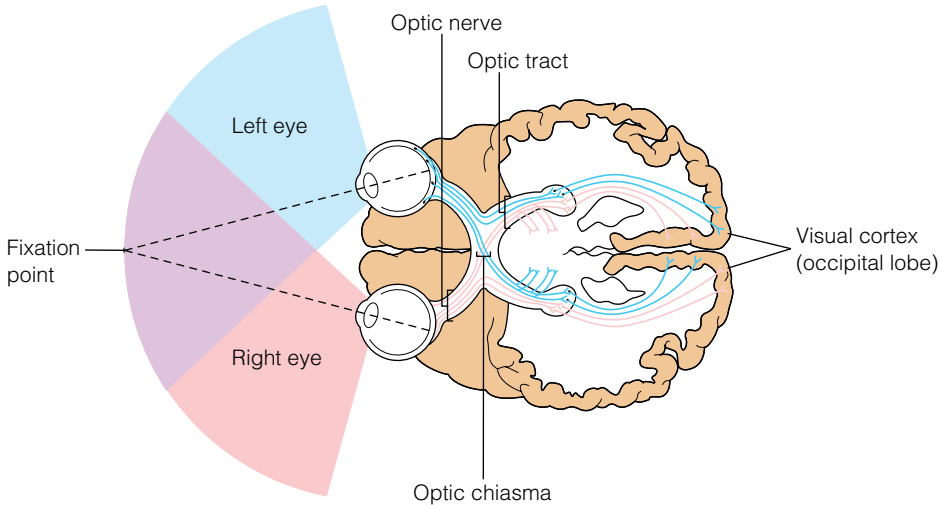


Figure 47–4 ■ The visual fields of the eye and the visual pathways to the brain.

tic radiations. The optic radiations terminate in the visual cortex of the occipital lobe. The nerve impulses that originated in the retina are interpreted here.

The visual fields of each eye overlap considerably, and each eye sees a slightly different view. Because of this overlap and the crossing of the axons, information from both eyes reaches each side of the visual cortex, which then fuses the information into one image. This fusion of images accounts for the ability to perceive depth; however, depth perception depends on visual input from two eyes that both focus well.

Refraction

Refraction is the bending of light rays as they pass from one medium to another medium of different optical density. As light rays pass through the eye, they are refracted at several points: as they enter the cornea, as they leave the cornea and enter the aqueous humor, as they enter the lens, and as they leave the lens and enter the vitreous humor. At the lens, the light is bent so that it converges at a single point on the retina. This focusing of the image is called **accommodation**. Because the lens is convex, the image projected onto the retina (the real image) is upside down and reversed from left to right. This real image is coded as electric signals that are sent to the brain. The brain decodes the image so that the person perceives it as it occurs in space.

The eyes are best adapted to see distant objects. Both eyes fix on the same distant image and do not require any change in accommodation. For people with emmetropic (normal) vision, the distance from the viewed object at which the eyes require no accommodation is 20 ft (6 m). This point is called the far point of vision. To focus for near vision, the eyes must instantly accommodate the lens, constrict the pupils, and converge the eyeballs. Accommodation is accomplished by contraction of the ciliary muscles. This contraction reduces the tension on the lens capsule so that it bulges outward to increase the curvature. This change in shape also achieves a shorter focal length, another requirement for focusing close images on the retina. The closest point on which a person can focus is called the near point of vision; in young adults with normal vision this is usually 8 to 10 inches (20 to 25 cm). Pupillary constriction helps eliminate most of the divergent light rays and sharpens focus. **Convergence** (the medial rotation of the eyeballs so that each is directed toward the viewed object) allows the focusing of the image on the retinal fovea of each eye.

ASSESSING THE EYES

Structures and functions of the eyes are assessed by findings from diagnostic tests, a health assessment interview to collect subjective data, and a physical assessment to collect objective data.

Diagnostic Tests

The results of diagnostic tests of the structure and functions of the eyes are used to support the diagnosis of a specific injury, disease, or vision problem; to provide information to identify or modify the appropriate medications or assistive devices used to treat the disease or problem; and to help nurses monitor the client's responses to treatment and nursing care interventions. Diagnostic tests of the eye, especially for vision testing, are most often conducted in a healthcare provider's office. Diagnostic tests to assess the structure and functions of the eyes are described in the Diagnostic Tests table on the next page and summarized in the following bulleted list. More information is included in the discussion of specific injuries or diseases in Chapter 48 ∞.

- Refractive errors (with prescription for corrective lenses) are evaluated by retinoscopy and/or refractometry. Pupils must be dilated for accurate diagnosis.
- Tonometry is used to identify and evaluate increased intraocular pressure, characteristic of glaucoma.
- A CT scan may be used to identify foreign objects or tumors of the eye.

Regardless of the type of diagnostic test, the nurse is responsible for explaining the procedure and any special preparation needed, for assessing any medication use that might affect the outcome of the tests, for supporting the client during the examination as necessary, for documenting the procedures as appropriate, and for monitoring the results of the tests.

DIAGNOSTIC TESTS of Eye Disorders

NAME OF TEST Refraction, Retinoscopy, Refractometry

PURPOSE AND DESCRIPTION Used to measure refractive error. Either a handheld retinoscope or an instrument with multiple lenses is used; with latter method, client chooses lenses that provide best vision.

RELATED NURSING CARE No special preparation is needed; tell client that pupils will be dilated with medication and may be enlarged for several hours.

NAME OF TEST Tonometry

PURPOSE AND DESCRIPTION Used to diagnose increased intraocular pressure in glaucoma. A variety of methods are used, ranging from a handheld instrument (tonometer) to a computerized component of the device used to evaluate refraction. The cornea is anesthetized prior to being touched with the device. **Normal value:** 10–22 mmHg

RELATED NURSING CARE No special preparation is needed.

NAME OF TEST Computed tomography (CT) scan of the eye

PURPOSE AND DESCRIPTION Radiologic examination used to identify foreign objects or tumors within the eyeball or orbit.

RELATED NURSING CARE No special preparation is needed.

Genetic Considerations

When conducting a health assessment interview and a physical assessment, it is important for the nurse to consider genetic influences on health of the adult. Several diseases of the eyes have a genetic component. During the health assessment interview, ask about a family history of glaucoma or blindness.

During the physical assessment, assess for any manifestations that might indicate a genetic disorder (see the Genetic Considerations box below). If data are found to indicate genetic risk factors or alterations, ask about genetic testing and refer for appropriate genetic counseling and evaluation. Chapter 8 provides further information about genetics in medical-surgical nursing.

Health Assessment Interview

A health assessment interview to determine problems with the eyes and vision may be conducted during a health screening, may focus on a chief complaint (such as blurred vision or an eye infection), or may be part of a total health assessment. If the client has a health problem involving one or both eyes, analyze its onset, characteristics and course, severity, precipitating and relieving factors, and any associated symptoms, noting the timing and circumstances. For example, you may ask the client:

- Describe the type of pain you experience in your eyes. When did it begin? How long does it last?
- Have you noticed rings of color around streetlights at night?
- When did you first notice having difficulty reading the paper?

Throughout the interview, be alert to nonverbal behaviors (such as squinting or abnormal eye movements) that suggest problems with eye function. Explore problems such as watery, irritated eyes or changes in vision. Assess the client's use of corrective eyewear and care of eyeglasses or contact lenses. If the client uses eye medications, ask about the type and purpose as well as the frequency and duration of use. When taking the history, find out about eye trauma, surgery, or infections, as well as the date and results of the last eye examination. In addition, ask the client about a medical history of diabetes, hypertension, thyroid disorders, glaucoma, cataracts, and eye infections. Include questions about a family history of nearsightedness or farsightedness, cancer of the retina, color blindness, and any other eye or vision disorders.

Collect information about environmental or work exposure to irritating chemicals, participation in sports or hobbies that pose the risk of eye injury, and the use of protective eyewear during dangerous activities, such as sawing wood or using a grass trimmer.

Interview questions categorized by functional health patterns are listed in the Functional Health Pattern Interview table on the next page.

GENETIC CONSIDERATIONS Eye Disorders

- *Glaucoma* is a term used for a group of diseases that damage the optic nerve and cause blindness. About 3 million people have a form of glaucoma, with nearly 100,000 of those in the United States having a form that is a genetic mutation (National Institutes of Health [NIH], 2003a).
- Gyrate atrophy of the choroid and retina is a genetic disorder resulting in a progressive vision loss, with total blindness occurring between ages 40 and 60.
- Best disease is a familial disorder found most often in Caucasians who originated in Europe. The disease causes gradual loss of vision, beginning during the teenage years.

Physical Assessment of the Eyes and Vision

Physical assessment of the eyes and of visual acuity may be performed as part of a total assessment or separately for clients

FUNCTIONAL HEALTH PATTERN INTERVIEW The Eye

Functional Health Pattern	Interview Questions and Leading Statements
Health Perception-Health Management	■ Describe your vision. Rate it on a scale of 1 to 10, with 10 being excellent vision. Is it the same in both eyes? If not, which eye is better? ■ Describe your current vision problems. How have these been treated? ■ What eye medications do you use? What type and how often? ■ Have you ever had eye surgery? Describe. ■ Describe the type of corrective lens that you use. Are you satisfied with this appliance? How do you care for it? ■ Describe how you care for your eyes each day. ■ Do you wear sunglasses when you are outside? ■ When was your last eye examination? Have you been tested for glaucoma?
Nutritional-Metabolic	■ Do you have any redness, swelling, watering, or dryness of your eyes?
Activity-Exercise	■ Does your vision problem interfere with your usual activities of daily living? Explain. ■ Do you wear protective goggles when you take part in activities that increase the risk of injury to your eyes (such as at work or when operating machinery at home)?
Sleep-Rest	■ Does your eye problem interfere with your ability to rest or sleep (for example, from pain)? If so, what do you do?
Cognitive-Perceptual	■ Do you have any difficulty focusing on objects? If so, do you have more difficulty with near objects or far objects? ■ Is your vision blurry? Do you see halos around lights? Do you see flashes of light or "floaters"? Do you see double? ■ Do you have pain in or around your eyes? If so, describe its location, intensity, what makes it worse, and how long it lasts. How do you treat it?
Self-Perception-Self-Concept	■ Has this problem with your eyes affected how you feel about yourself?
Role-Relationships	■ How has having this condition affected your relationships with others? ■ Has having this condition interfered with your ability to work? Explain. ■ Has anyone in your family had problems with eye disease? Explain.
Sexuality-Reproductive	■ Has this condition interfered with your usual sexual activity?
Coping-Stress-Tolerance	■ Has having this condition created stress for you? If so, does your health problem seem to be more difficult when you are stressed? ■ Have you experienced any kind of stress that makes the condition worse? Explain. ■ Describe what you do when you feel stressed.
Value-Belief	■ Describe how specific relationships or activities help you cope with this problem. ■ Describe specific cultural beliefs or practices that affect how you care for and feel about this problem. ■ Are there any specific treatments that you would not use to treat this problem?

with known or suspected problems of the eyes. The eyes and vision are primarily assessed through inspection of external structures and assessment of visual fields and visual acuity, extraocular muscle function, and internal structures. Palpation (e.g., of a blocked lacrimal duct) may be used if a problem is identified. Prior to the examination, explain the techniques to the client to decrease anxiety. The client may sit or stand during the assessment. Normal age-related findings for the older adult are summarized in Table 47–1.

Assessing Visual Fields

Visual fields are tested to assess the functioning of the macula and peripheral vision. The visual fields of the examiner (which must be normal to perform this assessment) are used as the standard. To measure visual fields, sit directly opposite the client at a distance of 18 to 24 inches. Ask the client to cover one eye with the opaque cover while you cover your own eye opposite to the client (for example, if the client covers the right eye, you cover your left eye). Ask the client to look directly at you. Move the penlight from the periphery toward the center from right to left, above and below, and from the middle of each of these directions. Both you and the client should see the penlight enter the field of vision at the same time, if the examiner has normal peripheral vision.

The central visual field may be assessed with an Amsler grid (Figure 47–5 ■). The most basic form has black lines on a white

TABLE 47–1 **Age-Related Changes in the Eye**

AGE-RELATED CHANGE	SIGNIFICANCE
The lens:	
■ ↓ elasticity, decreasing focus and accommodation for near vision (presbyopia). ■ ↑ density and size, making lens more stiff and opaque. ■ Yellowing of the lens and changes in the retina affect color perception.	Most older adults require corrective lenses to accommodate close and detailed work. Increased opacity leads to the development of cataracts. As cataracts develop, they increase sensitivity to glare and interfere with night vision.
The cornea:	
■ Fat may be deposited around the periphery and throughout the cornea. ■ ↓ corneal sensitivity.	A partial or complete white circle may form around the cornea (*arcus senilis*). Lipid deposits in the cornea cause vision to be blurred. Decreased sensitivity increases the risk of injury to the eye.
The pupil:	
■ ↓ size and responsiveness to light pupil; sphincter hardens.	Increased light perception threshold and difficulty seeing in dim light or at night means increased light is needed to see adequately.
The retina and visual pathways:	
■ Visual fields narrow. ■ Photoreceptor cells are lost. ■ Rods work less effectively. ■ Macular degeneration is a risk. ■ Depth perception is distorted. ■ Adaptation to dark and light takes longer.	Peripheral vision is decreased and central vision may be lost from macular degeneration. Increased risk of falls as a result of changes in depth perception and adaptation to changes in light. Vision progressively declines with age.
The lacrimal apparatus:	
■ ↓ reabsorption of intraocular fluid. ■ ↓ production of tears.	Increased risk of developing glaucoma, and eyes feel and look dry.
The posterior cavity:	
■ Debris and condensation become visible. ■ Vitreous body may pull away from the retina.	Vision is blurred and distorted, and "floaters" are often seen by the older person.

grid, forming squares (boxes) that measure 5 mm. There is a black dot in the center of the grid. The Amsler grid is useful for identifying early changes in vision from macular degeneration and diabetes mellitus. To use the Amlser grid, ask the client to hold the grid at normal reading distance (about 12 to 14 inches), cover one eye, and stare at the center dot. Ask the client if any of the lines look crooked or bent, if any of the boxes are different in size or shape, and if any of the lines are wavy, missing, blurry, or discolored. Repeat with the other eye. The test should be conducted before the pupils are dilated, and the client should be wearing their best correction.

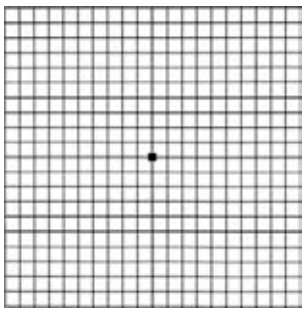


Figure 47–5 ■ The Amsler grid.

EYE AND VISION ASSESSMENTS

Vision Assessment

Visual acuity is assessed with an eye chart such as the Snellen chart or the E chart for testing distance vision and the Rosenbaum chart for testing near vision. The Snellen chart contains rows of letters in various sizes, with standardized numbers at the end of each row. The number at the end of the row indicates the visual acuity of a client who can read the row at a distance of 20 feet. (If the client is unable to read or does not read English, you can use the E chart to test visual acuity.) The top number at the end of the row is always 20, representing the distance between the client and the chart. The bottom number is the distance (in feet) at which a person with normal vision can read the line. A person with normal vision can read the row marked 20/20. To conduct the assessment, ask the person to stand 20 feet from the chart in a well-lit area. Ask the client to cover one eye with an opaque cover (Figure 47–6 ■). Then ask the client to read each

row of letters, moving from largest letters to the smallest ones that the client can see. Measure visual acuity in the other eye in the same way, and then assess visual acuity while the client has both eyes uncovered. You may test the client who wears corrective lenses with and without the lenses.

The Rosenbaum chart is held at a distance of from 12 to 14 inches from the eyes, with visual acuity measured in the same manner as with the Snellen chart (Figure 47–7 ■). A gross estimate of near vision may also be assessed by asking the person to read from a magazine or newspaper.

Figure 47–6 ■ Testing distant vision using the Snellen eye chart.

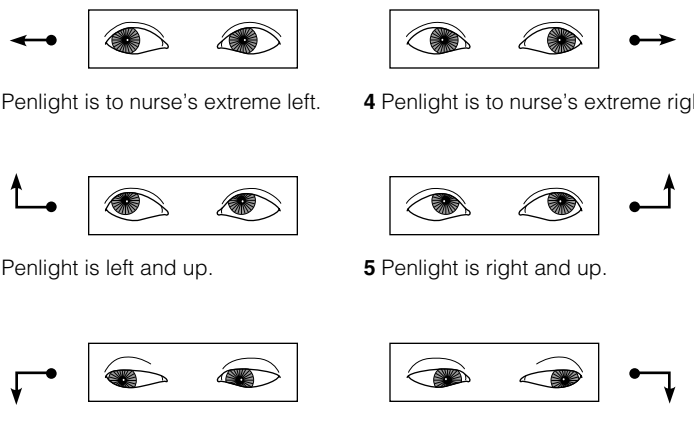
Figure 47–7 ■ Testing near vision using Rosenbaum eye chart.

Technique/Normal Findings	Abnormal Findings
Assess distant vision, using the Snellen or E chart. *When standing 20 feet from the chart, the client can read the smallest line of letters with or without corrective lenses (recorded as 20/20).*	■ Changes in distant vision are most commonly the result of **myopia** (nearsightedness). For example, a reading of 20/100 indicates impaired distance vision. A person has to stand 20 feet from the chart to read a line that a person with normal vision could read 100 feet from the chart.
Assess near vision, using a Rosenbaum chart or a card with newsprint held 12 to 14 inches from the client's eyes. *Normal near visual acuity is 14/14 with or without corrective lenses.*	■ Changes in near vision, especially in clients over age 45, can indicate **presbyopia**, impaired near vision resulting from a loss of elasticity of the lens related to aging. In younger clients, this condition is referred to as **hyperopia** (farsightedness).

Eye Movement Assessment

Assess the cardinal fields of vision to gain information about extraocular eye movements. Ask the client to follow a pen or your finger while keeping the head stationary. Move the pen or your finger through the six fields one at a time, returning to the central starting point before proceeding to the next field (Figure 47–8 ■). *The eyes should move through each field without involuntary movements.*

- Failure of one or both eyes to follow the object in any given direction may indicate extraocular muscle weakness or cranial nerve dysfunction.
- An involuntary rhythmic movement of the eyes, **nystagmus**, is associated with neurologic disorders and the use of some medications.



1 Penlight is to nurse's extreme left.
4 Penlight is to nurse's extreme right.
2 Penlight is left and up.
5 Penlight is right and up.
3 Penlight is left and down.
6 Penlight is right and down.

Figure 47–8 ■ The six cardinal fields of vision.

MEDIALINK Case Study: Identifying Common Pathologies

Technique/Normal Findings	Abnormal Findings
The cover–uncover test is a test for strabismus, a weakening of a muscle that causes one eye to deviate from the other when the person is focusing on an object. To conduct the test, hold a pen or your finger about 1 foot from the eyes and ask the person to focus on that object. Cover one of the client's eyes and note any movement in the uncovered eye; as you remove the cover, assess for movement in the eye that was just uncovered. Repeat the procedure with the other eye. *The uncovered eye should remain fixed straight ahead. The covered eye should remain fixed straight ahead after being uncovered.*	
Assess convergence. Ask the client to follow an object as you move it toward the client's eyes. *Normally both eyes converge toward the center.*	■ Failure of the eyes to converge equally on an approaching object may indicate a neuromuscular disorder or improper eye alignment.
Assess the corneal light reflex. Direct a light source onto the bridge of the nose from 12 to 15 inches. *Observe for equal reflection of the light from each eye.*	■ Reflections of the light from different sites on the eyes reveal improper alignment.
Pupillary Assessment	
Observe pupil size and equality. *Pupils should be of equal size, 3 to 5 mm.*	■ Pupils that are unequal in size may indicate a severe neurologic problem, such as increased intracranial pressure.
Assess direct and consensual pupil response. Ask the client to look straight ahead. Shine a light obliquely into one eye at a time. Observe for constriction of the pupil in the illuminated eye. Test both eyes. To test consensual pupil response, again shine a light obliquely into one eye at a time as the client looks straight ahead. Observe constriction of the pupil in the opposite eye. *The normal direct and consensual pupillary response is constriction.*	■ Failure of the pupils to respond to light may indicate degeneration of the retina or destruction of the optic nerve. ■ A client who has one dilated and unresponsive pupil may have paralysis of the oculomotor nerve. ■ Some eye medications may cause unequal dilation, constriction, or inequality of pupil size. Morphine and narcotic drugs may cause small, unresponsive pupils, and anticholinergic drugs such as atropine may cause dilated, unresponsive pupils.

Technique/Normal Findings	Abnormal Findings
Test for accommodation. Hold an object at a distance of a few feet from the client. The pupils should dilate. Ask the client to follow the object as you bring it to within a few inches of the client's nose. *The pupils should constrict and converge as they change focus to follow the object.*	■ Failure of accommodation along with lack of pupil response to light may signal a neurologic problem. ■ Lack of response to light with appropriate response to accommodation is often seen in clients with diabetes.

External Eye Assessment

Inspect the eyelids. *Eyelids should be the color of the client's facial skin, without redness, discharge, or drooping. The sclera should not be visible.*

- Unusual redness or discharge may indicate an inflammatory state due to trauma, allergies, or infection.
- Drooping of one eyelid, called **ptosis**, may be the result of a stroke, indicate a neuromuscular disorder, or be congenital (Figure 47–9 ■).
- Unusual widening of the lids may be due to exophthalmos, protrusion of the eyeball. Exophthalmos is often associated with hyperthyroid conditions (see Chapter 19 ∞).
- Yellow plaques noted on or near the lid margins are referred to as xanthelasma and may indicate high lipid levels.
- An acute localized inflammation of a hair follicle is known as a *hordeolum* (sty) and is generally caused by staphylococcal organisms.
- A *chalazion* is an infection or retention cyst of the meibomian glands.

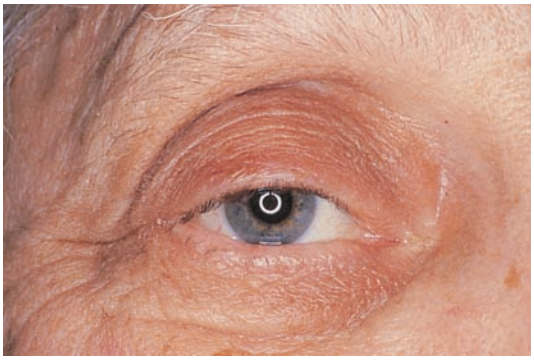


Figure 47–9 ■ Ptosis.
Source: Leonard Lessen/Peter Arnold, Inc.
Source: Custom Medical Stock Photo, Inc.

Inspect the puncta. *The puncta should be free of redness or discharge.*

- Unusual redness or discharge from the puncta may indicate an inflammation due to trauma, infection, or allergies.

Inspect the bulbar and palpebral conjunctiva. *The conjunctiva should be clear, moist, and smooth. The upper and lower palpebral conjunctiva should be clear, without redness or swelling.*

- Increased erythema or the presence of exudate may indicate acute conjunctivitis.
- A cobblestone appearance is often associated with allergies.
- A fold in the conjunctiva, called a *pterygium*, may be seen as a clouded area that extends over the cornea. This is an abnormal growth of the bulbar conjunctiva, usually seen on the nasal side of the cornea. It may interfere with vision if it covers the pupil.

Inspect the sclera. *The sclera is white in Caucasians; people with darker skin normally have yellow sclera.*

- Unusual redness may indicate an inflammatory state as a result of trauma, allergies, or infection.
- Yellow discoloration of the sclera in clients with fair skin may be seen in conditions involving the liver, such as hepatitis.
- Bright red areas in the sclera are often subconjunctival hemorrhages and may indicate trauma or bleeding disorders. They may also occur spontaneously.

Inspect the cornea. *The cornea is normally transparent.*

- Dullness, opacities, or irregularities of the cornea may be abnormal.
- *Corneal arcus* is a thin, grayish white arc seen toward the edge of the cornea. It is normal in older clients.

Assess corneal sensitivity. Lightly touch a wisp of cotton to the client's cornea. *This action should cause a corneal reflex (blinking the eye).*

- Failure of the corneal reflex may indicate a neurologic disorder.

Technique/Normal Findings	Abnormal Findings
Inspect the iris. *The iris is normally round, flat, and evenly colored.*	■ Lack of clarity of the iris may indicate a cloudiness of the cornea. ■ Constriction of the pupil accompanied by pain and circumcorneal redness indicates acute iritis.
Internal Eye Assessment **Assess internal structures of the eye by using the ophthalmoscope, an instrument that allows visualization of the lens, the vitreous humor, and the retina. Box 47–1 provides guidelines for using the ophthalmoscope.**	
Inspect for the red reflex. *The red reflex should be clearly visible.*	■ Absence of a red reflex often indicates improper position of the ophthalmoscope, but also may indicate total opacity of the pupil by a cataract or a hemorrhage into the vitreous humor.
Inspect the lens and vitreous body. *The lens should be clear.*	■ A cataract is an opacity of the lens, often seen as a dark shadow on ophthalmoscopic examination. It may be due to aging, trauma, diabetes, or a congenital defect.
Inspect the retina. *There should be no visible hemorrhages, exudate, or white patches.*	■ Areas of hemorrhage, exudate, and white patches may be a result of diabetes or long-standing hypertension.
Inspect the optic disc. *The optic disc should be round to oval in shape with clear, well-defined borders.*	■ Loss of definition of the optic disc, as well as an increase in the size of the physiologic cup, is seen in papilledema from increased intracranial pressure.
Inspect the blood vessels of the retina. *The retinal blood vessels should be distinct.*	■ Glaucoma often results in displacement of blood vessels from the center of the optic disc due to increased intraocular pressure. ■ Hypertension may cause a narrowing of the vein where an arteriole crosses over. ■ Engorged veins may occur with diabetes, atherosclerosis, and blood disorders.
Inspect the retinal background. *The retina should be a consistent red-orange color, becoming lighter around the optic disc.*	■ Variations in color or a pale color overall may indicate disease.
Inspect the macula. *The macula should be visible on the temporal side of the optic disc.*	■ Absence of the fovea centralis is common in older clients. It may indicate macular degeneration, a cause of loss of central vision.
Palpate over the lacrimal glands, puncta, and nasolacrimal duct. *There should be no tenderness, drainage, or excessive tearing.*	■ Tenderness over any of these areas or drainage from the puncta may indicate an infectious process. (Wear gloves if you see any drainage.) ■ Excessive tearing may indicate a blockage of the nasolacrimal duct.

ANATOMY, PHYSIOLOGY, AND FUNCTIONS OF THE EARS

As a sensory organ, the ears have two primary functions, hearing and maintaining equilibrium. Anatomically, each ear is divided into three areas: the external ear, the middle ear, and the inner ear (Figure 47–10 ■). Each area has a unique function. All three are involved in hearing, but only the inner ear is involved in equilibrium.

The External Ear

The external ear consists of the auricle (or pinna), the external auditory canal, and the tympanic membrane.

The auricles are elastic cartilage covered with thin skin. They contain sebaceous and sweat glands and sometimes hair. Each auricle has a rim (the helix) and a lobe. The auricle serves to direct sound waves into the ear.

The external auditory canal, which is about 1 inch (2.5 cm) long, extends from the auricle to the tympanic membrane. The canal is lined with skin that contains hair, sebaceous glands, and ceruminous glands. The external auditory canal serves as a resonator for the range of sound waves typical of human speech and increases the pressure that sound waves in this frequency

BOX 47–1 **Guidelines for Using the Ophthalmoscope**

The ophthalmoscope has a head and a handle. (See the figure below.) The head contains a focus wheel (also called a lens selector dial) located on the side, lenses of varying magnification, and an opening through which the eye structures are visualized. The focus wheel adjusts the lens refraction, which is measured in diopters. The diopter measurements range from 0 to +40 when the lens is rotated clockwise, and from 0 to −25 when the lens is rotated counterclockwise. By moving the focus wheel, the examiner can converge or diverge light rays to visualize the retina.

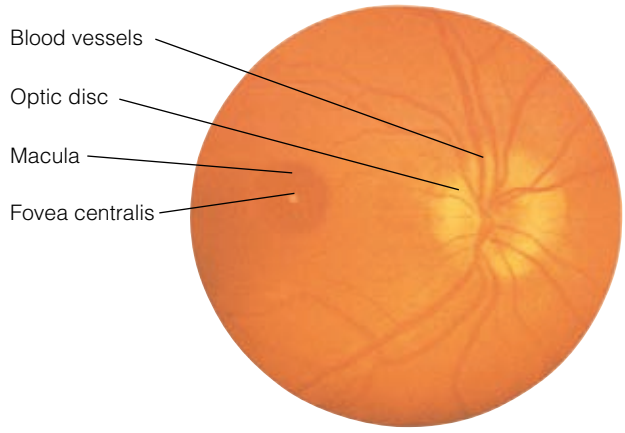
The handle usually contains batteries that can be recharged.

Before the examination, explain the procedure to the client. Assemble the ophthalmoscope. Wash your hands and wear disposable gloves if the client has any drainage from the eyes. Darken the room (to allow the pupils of the client to dilate), and ask the client to look straight ahead, focusing on a fixed point such as an object on the wall. Hold the ophthalmoscope in one hand, resting the index finger on the focus wheel (see the figure at right).

1. Turn on the ophthalmoscope light, and set focus wheel to 0 diopters. Hold the ophthalmoscope in your right hand with your index finger on the focus wheel. Standing in front of the client, position yourself at a 15-degree angle to the client's line of vision.
2. Hold the opening of the ophthalmoscope up to your right eye and direct the light toward the client's right eye from a distance of about 12 inches.
3. As the beam of light falls on the client's pupil, observe for the red reflex, which appears as a sharply outlined orange glow from within the pupil. This glow is the reflection of the light from the retina.
4. Move closer to the client, turning the focus wheel clockwise toward the positive numbers as needed to maintain clear focus.
5. Examine the lens and the vitreous body, both of which should be clear.
6. Gradually rotate the focus wheel counterclockwise toward the negative numbers as needed, focusing on a structure of the retina (such as the disc or a blood vessel). Turn the focus wheel until the image is clear. Examine the structures of the retina as follows:
   a. The optic disc (see the accompanying figure). Assess for size, shape, color, distinct margins, and the physiologic cup. The disc is round to slightly oval and about 1.5 mm in diameter. It has a yellow to pink color that is lighter than the retina itself. The margins should be sharp and clear. The physiologic cup is a small depression that occupies about one-third of the optic disc, lying temporal to the center of the disc.
   b. The vessels of the retina. Assess for color, arteriolar light reflex, ratio of arterioles to veins, and arteriovenous crossings. The arterioles are red, brighter than the veins, and about one-fourth smaller. The arterioles normally have a narrow light reflex from the center of each vessel; veins do not have this light reflex. The ratio of arterioles to veins is usually 2:3 or 4:5. The vessels normally cross and become smaller toward the periphery.
   c. The retinal background. Assess color and changes in color. The retina is normally reddish orange and regular in color.
   d. The macula. Assess size and color. To assess the macula, ask the client to look directly into the ophthalmoscope light. The macula is temporal to the optic disc, appears slightly darker than the retina, and has no visible vessels. The fovea centralis may be seen as a bright spot of light. Because looking directly into the light causes some discomfort, conduct this portion of the examination last. The macula is often difficult to visualize.
7. Using the same technique, examine the left eye.

Technique for holding an ophthalmoscope.

An ophthalmoscope.



The optic disc.

Source: Don Wong/Science Source/Photo Researchers, Inc.

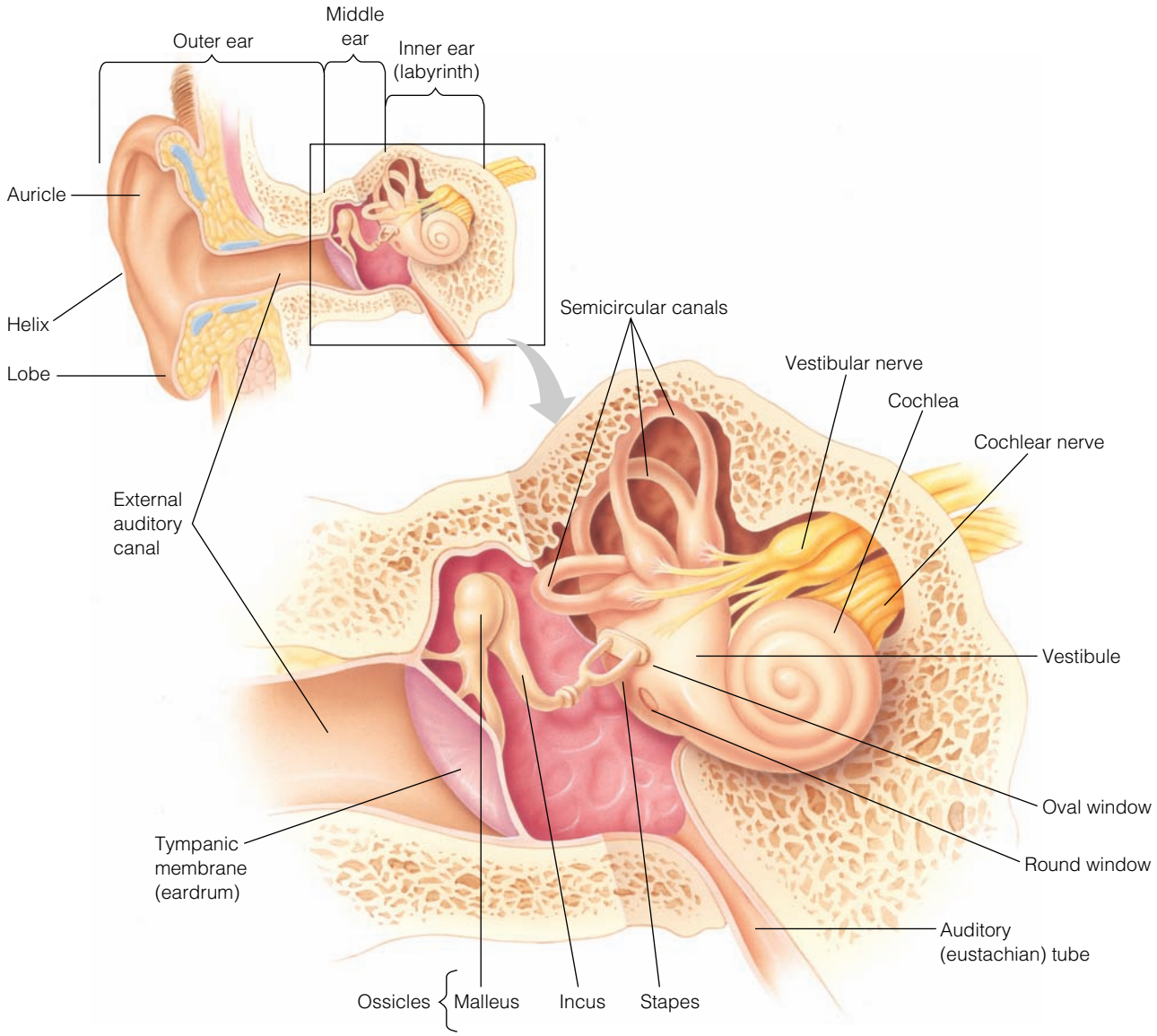


Figure 47–10 ■ Structures of the external ear, middle ear, and inner ear.
Source: Todd Buck.

range place on the tympanic membrane. The canal's ceruminous glands (modified apocrine glands) secrete a yellow to brown waxy substance called **cerumen** (earwax). Cerumen traps foreign bodies; it also has bacteriostatic properties, protecting the tympanic membrane and the middle ear from infections.

The tympanic membrane lies between the external ear and the middle ear. It is a thin, semitransparent, fibrous structure covered with skin on the external side and mucosa on the inner side. The membrane vibrates as sound waves strike it; these vibrations are transferred as sound waves to the middle ear.

The Middle Ear

The middle ear is an air-filled cavity in the temporal bone. The middle ear contains three auditory ossicles: the malleus, the incus, and the stapes. These bones extend across the middle ear. The medial side of the middle ear is a bony wall containing two membrane-covered openings, the oval window and the round window. The posterior wall of the middle ear contains the mastoid antrum. This cavity communicates with the mastoid sinuses, which help the middle ear adjust to changes in pressure. It also opens into the eustachian tube, which connects with the nasopharynx. The eustachian tube helps to equalize the air pressure in the middle ear by opening briefly in response to differences between middle ear pressure and atmospheric pressure. This action also ensures that vibrations of the tympanic membrane remain adequate. The mucous membrane lining the middle ear is continuous with the mucous membranes lining the throat.

The malleus attaches to the tympanic membrane and articulates with the incus, which in turn articulates with the stapes. The stapes fits into the oval window. When the tympanic membrane vibrates, the vibrations are conducted across the middle ear to the oval window by the ossicles. The vibrations then set in motion the fluids of the inner ear, which in turn stimulate the

hearing receptors. Two small muscles attached to the ossicles contract reflexively in response to sudden loud noises, decreasing the vibrations and protecting the inner ear.

The Inner Ear

The inner ear, also called the labyrinth, is a maze of bony chambers located deep within the temporal bone, just behind the eye socket. The labyrinth is further divided into two parts: the bony labyrinth, a system of open channels that houses the second part, the membranous labyrinth. The bony labyrinth is filled with a fluid (similar to cerebrospinal fluid) called perilymph, which bathes the membranous labyrinth. Within the chambers of the membranous labyrinth is a fluid called endolymph.

The bony labyrinth has three regions: the vestibule, the semicircular canals, and the cochlea. The vestibule is the central portion of the inner ear, one side of which is a bony wall containing the oval window. Two sacs within the vestibule (the saccule and the utricle) join the vestibule with the cochlea and the semicircular canals. The saccule and the utricle contain receptors for equilibrium that respond to changes in gravity and changes in position of the head. The three semicircular canals each project into a different plane (anterior, posterior, and lateral). Each canal contains a semicircular duct that communicates with the utricle of the vestibule. Each duct has an enlarged area at one end containing an equilibrium receptor that responds to angular movements of the head.

The cochlea is a tiny bony chamber that houses the organ of Corti, the receptor organ for hearing. The organ of Corti is a series of sensory hair cells, arranged in a single row of inner hair cells and three rows of outer hair cells. The hair cells are innervated by sensory fibers from cranial nerve VIII. The organ of Corti is supported in the cochlea by the flexible basilar membrane, which has fibers of varying lengths that respond to different sound wave frequencies.

Sound Conduction

Hearing is the perception and interpretation of sound. Sound is produced when the molecules of a medium are compressed, resulting in a pressure disturbance evidenced as a sound wave. The intensity or loudness of sound is determined by the amplitude (height) of the sound wave, with greater amplitudes causing louder sounds. The frequency of the sound wave in vibrations per second determines the pitch or tone of the sound, with higher frequencies resulting in higher sounds. The human ear is most sensitive to sound waves with frequencies between 1000 and 4000 cycles per second, but can detect sound waves with frequencies between 20 and 20,000 cycles per second.

Sound waves enter the external auditory canal and cause the tympanic membrane to vibrate at the same frequency. The ossicles not only transmit the motion of the tympanic membrane to the oval window but also amplify the energy of the sound wave. As the stapes moves against the oval window, the perilymph in the vestibule is set in motion. The increased pressure of the perilymph is transmitted to fibers of the basilar membrane and then to the organ of Corti (directly above the basilar membrane). The up-and-down movements of the fibers of the basilar membrane pull the hair cells in the organ of Corti, which in turn generates action potentials that are transmitted to cranial nerve VIII and then to the brain for interpretation.

Several brainstem auditory nuclei transmit impulses to the cerebral cortex. Fibers from each ear cross, with each auditory cortex receiving impulses from both ears. Auditory processing is so finely tuned that a wide variety of sounds of different pitch and loudness can be heard at any one time. In addition, the source of the sound can be localized.

Equilibrium

The inner ear also provides information about the position of the head. This information is used to coordinate body movements so that equilibrium and balance are maintained. The types of equilibrium are static balance (affected by changes in the position of the head) and dynamic balance (affected by the movement of the head).

Receptors called maculae in the utricle and the saccule of the vestibule detect changes in the position of the head. Maculae are groups of hair cells that have protrusions covered with a gelatinous substance. Embedded in this gelatinous substance are tiny particles of calcium carbonate called otoliths (ear stones), which make the gelatin heavier than the endolymph that fills the membranous labyrinth. As a result, when the head is in the upright position, gravity causes the gelatinous substance to bear down on the hair cells. When the position of the head changes, the force on the hair cells also changes, bending them and altering the pattern of stimulation of the neurons. Thus, a different pattern of nerve impulses is transmitted to the brain, where stimulation of the motor centers initiates actions that coordinate various body movements according to the position of the head.

The receptor for dynamic equilibrium is in the crista, a crest in the membrane lining the ampulla of each semicircular canal. The cristae are stimulated by rotatory head movement (acceleration and deceleration) as a result of changes in the flow of endolymph and of movement of hair cells in the maculae. The direction of endolymph and hair cell movement is always opposite to the motion of the body.

ASSESSING THE EARS

The structure and functions of the ears are assessed by findings from diagnostic tests, a health assessment interview to collect subjective data, and a physical assessment to collect objective data. See the next page for sample documentation of an ear assessment.

Diagnostic Tests

The results of diagnostic tests of the structure and functions of the ears are used to support the diagnosis of a specific injury, disease, or hearing problem; to provide information to identify or modify the appropriate medications or assistive devices used to treat the disease or problem; and to help nurses monitor the client's responses to treatment and nursing care interventions. Diagnostic tests of the ear, especially for hearing, are most often conducted in a healthcare

SAMPLE DOCUMENTATION
Assessment of the Ear

22-year-old male with complaints of "having some problems hearing these days." States he often listens to music in his car "as loud as it will go" and uses ear phones at home so he does not bother other family members. Ears are normally placed bilaterally; skin smooth without lesions. Small amount of dark brown cerumen present in ear canals. Tympanic membranes gray and shiny. No bulging or retraction noted. Whisper test: Unable to repeat back words spoken by examiner. Weber's test: Sound lateralized to left ear. Rinne test: BC ≥ AC. No tenderness noted when mastoids palpated. Referred to ear clinic for further evaluation.

provider's office. Diagnostic tests to assess the structure and functions of the ears are described in the Diagnostic Tests table below and summarized in the following bulleted list. More information is included in the discussion of specific injuries or diseases in Chapter 48 ∞.

- Audiometry is used to evaluate and diagnose conductive and sensorineural hearing loss.
- Electrical activity of the auditory nerve may be evaluated by using an auditory evoked potential (AEP) or an auditory brainstem response (ABR).
- Vestibular system function is evaluated with a caloric test. If no nystagmus occurs during the test, further testing for brain lesions is conducted.

Regardless of the type of diagnostic test, the nurse is responsible for explaining the procedure and any special preparation needed, for assessing for any medication use that might affect the outcome of the tests, for supporting the client during the examination as necessary, for documenting the procedures as appropriate, and for monitoring the results of the tests.

Genetic Considerations

When conducting a health assessment interview and a physical assessment, it is important for the nurse to consider genetic influences on health of the adult. Several diseases of the ears have a genetic component. During the health assessment interview, ask about a family history of congenital deafness, deafness associated with a thyroid goiter, or tumors of the auditory nerve.

During the physical assessment, assess for any manifestations that might indicate a genetic disorder (see the Genetic Considerations box below). If data are found to indicate genetic risk factors or alterations, ask about genetic testing and refer for appropriate genetic counseling and evaluation. Chapter 8 ∞ provides further information about genetics in medical-surgical nursing.

Health Assessment Interview

The health history assessment to collect subjective data about the ears and hearing may be part of a health screening, may focus on a chief complaint (such as hearing problems or pain in

GENETIC CONSIDERATIONS
Ear Disorders

- Deafness (hearing loss) is a common disorder that is seen from newborns to those of old age. About 1 in 1000 infants have a profound hearing loss, with about half being genetic in origin (NIH, 2003b). Early diagnosis is important to facilitate language and social skill development in adults.
- Penred syndrome is an inherited disorder that accounts for as much as 10% of hereditary deafness. The deafness is usually accompanied by a thyroid goiter.
- Neurofibromatosis, a rare inherited disorder, is characterized by the development of acoustic neuromas (benign tumors of the auditory nerve) and malignant central nervous system tumors.

DIAGNOSTIC TESTS **of Ear Disorders**

NAME OF TEST Audiometry
PURPOSE AND DESCRIPTION Used to evaluate and diagnose conductive and sensorineural hearing loss. Client sits in soundproof room and responds by raising a hand when sounds are heard.
RELATED NURSING CARE No special preparation is needed.

NAME OF TEST Auditory evoked potential (AEP)
PURPOSE AND DESCRIPTION Used to identify electrical activity of the auditory nerve. Electrodes are placed on various areas of the ear and on the forehead and a graphic recording is made.
RELATED NURSING CARE No special preparation is needed.

NAME OF TEST Auditory brainstem response (ABR)
PURPOSE AND DESCRIPTION Measures electrical activity of the auditory pathway from inner ear to brain to diagnose brainstem pathology, stroke, and acoustic neuroma.
RELATED NURSING CARE No special preparation is needed.

NAME OF TEST Caloric test
PURPOSE AND DESCRIPTION Used to assess vestibular system function. Cold or warm water is used to irrigate the ear canals one at a time and the client is observed for nystagmus (repeated abnormal movements of the eyes). Normally, the nystagmus occurs opposite to the ear being irrigated. If no nystagmus occurs, the client needs further testing for brain lesions.
RELATED NURSING CARE Assess client for use of alcohol, central nervous system depressants, and barbiturates. These chemicals may alter the test results.

the ear), or may be part of a total health assessment. If the client has a problem involving one or both ears, analyze its onset, characteristics and course, severity, precipitating and relieving factors, and any associated symptoms, noting the timing and circumstances. For example, you may ask the following questions:

- Have you noticed any difficulty hearing high-pitched sounds, low-pitched sounds, or both?
- When did you first notice the ringing in your ears?
- Is your workplace very noisy? If so, do you wear protective ear equipment at work?

Throughout the examination, be alert to nonverbal behaviors (such as inappropriate answers or requests to repeat statements) that suggest problems with ear function. Explore changes in hearing, ringing in the ears (*tinnitus*), ear pain, drainage from the ears, or the use of hearing aids. When taking the history, ask about trauma, surgery, or infections of the ear as well as the date of the last ear examination. In addition, ask the client about a medical history of infectious diseases, such as meningitis or mumps, as well as the use of medications that may affect hearing. Because ear problems tend to run in families, ask about a family history of hearing loss, ear problems, or diseases that could result in such problems. If the client has a hearing aid, ascertain the type and assess measures for its care.

Interview questions categorized by functional health patterns are found in the Functional Health Pattern table below.

FUNCTIONAL HEALTH PATTERN INTERVIEW **The Ear**

Functional Health Pattern	Interview Questions and Leading Statements
Health Perception-Health Management	■ Describe your hearing. Rate it on a scale of 1 to 10, with 10 being excellent hearing. Is it the same in both ears? If not, which ear is better? ■ Describe your current hearing problems. How have these been treated? ■ Do you use ear medications? What type and how often? ■ Have you ever had ear surgery? Describe. ■ Describe the type of hearing aid that you use. Are you satisfied with this appliance? How do you care for it? ■ Describe how you care for your ears each day. ■ When was your last ear examination? Have you ever had your hearing tested? ■ Do you listen to loud music? Do you use ear phones when you listen to loud music?
Nutritional-Metabolic	■ Do you have any swelling or tenderness in the ears or drainage from the ears?
Activity-Exercise	■ Does your hearing problem interfere with your usual activities of daily living? Explain. ■ Do you wear protective earplugs when you take part in activities that increase the risk of injury to your ears (such as at work or when operating machinery at home)?
Sleep-Rest	■ Does your ear problem interfere with your ability to rest or sleep (for example, from pain)? If so, what do you do?
Cognitive-Perceptual	■ Do you have pain in or around your ears? Have you ever had ringing in your ears? If so, describe its location, intensity, what makes it worse, and how long it lasts. How do you treat it? ■ Do you have difficulty hearing conversations, either in person or on the telephone? Do you have trouble hearing the television? Do you have difficulty hearing when you are in crowds or there is background noise? ■ Have you noticed your hearing is different in each ear? ■ Do you have buzzing, ringing, or crackling noises in one or both ears? Explain. ■ Do you ever feel dizzy?
Self-Perception-Self-Concept	■ Has this problem with your ears affected how you feel about yourself?
Role-Relationships	■ How has having this condition affected your relationships with others? ■ Has having this condition interfered with your ability to work? Explain. ■ Has anyone in your family had problems with ear disease? Explain.
Sexuality-Reproductive	■ Has this condition interfered with your usual sexual activity?
Coping-Stress-Tolerance	■ Has having this condition created stress for you? If so, does your health problem seem to be more difficult when you are stressed? ■ Have you experienced any kind of stress that makes the condition worse? Explain. ■ Describe what you do when you feel stressed.
Value-Belief	■ Describe how specific relationships or activities help you cope with this problem. ■ Describe specific cultural beliefs or practices that affect how you care for and feel about this problem. ■ Are there any specific treatments that you would not use to treat this problem?

TABLE 47–2 Age-Related Changes in the Ear

AGE-RELATED CHANGE	SIGNIFICANCE
The inner ear:	
■ Loss of hair cells, ↓ blood supply, less flexible basilar membrane, degeneration of spiral ganglion cells, and ↓ production of endolymph result in progressive hearing loss with age (presbycusis). ■ High-frequency sounds are lost; middle and low-frequency sounds may also be lost or decreased. ■ Vestibular structures degenerate, organ of Corti and cochlea atrophy	Older adults may require hearing aids to hear well. With loss of high-frequency sounds, speech may be distorted, contributing to a risk for problems with communication. Degeneration and atrophy of inner ear structures concerned with balance and equilibrium increase the risk for falls.
The middle ear:	
■ Muscles and ligaments weaken and stiffen, decreasing the acoustic reflex.	Sounds made from one's own body and speech are louder and may further interfere with hearing, speech, and communications.
The external ear:	
■ Cerumen has a higher keratin content, contributing to increased cerumen in the ear canal.	Accumulated cerumen may impair hearing.

Physical Assessment of the Ears and Hearing

Physical assessment of the ears and hearing may be performed as part of a total health assessment or separately for clients with known or suspected problems with the ears. The ears and hearing are assessed primarily through inspection of external structures, the external auditory canal, and the tympanic membrane. Disorders of the middle ear may be identified with tympanometry. Hearing acuity is assessed by voice tests and tuning fork tests. The external structures may be palpated. Normal age-related findings for the older adult are summarized in Table 47–2.

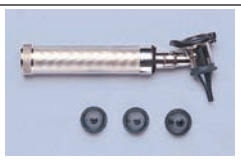
The client should be sitting, and the examiner's head should be level with the head of the client. Prior to the assessment, collect all necessary equipment and explain the techniques to the client to decrease anxiety. The auditory canal and tympanic membrane are inspected with the otoscope. Guidelines for use of the otoscope are listed in Box 47–2.

BOX 47–2 Guidelines for Using the Otoscope

The otoscope has a handle that contains batteries for the light and various specula that fit onto the handle. (See the accompanying figure.) This instrument is used to inspect the auditory canal and the tympanic membrane. A pneumatic otoscope is used to determine the mobility of the tympanic membrane. A pneumatic otoscope has an attached rubber bulb that can be squeezed to inject air into the auditory canal, causing a normal tympanic membrane to move in and out.

Before the examination, explain the procedure to the client. Assemble the otoscope, using the largest speculum that will fit into the client's auditory canal without discomfort. Wash your hands; wear disposable gloves if the client has any drainage from the ears. Turn on the otoscope light. Ask the client to tip the head slightly toward the shoulder opposite the ear being examined. When the client is in this position, the auditory canal is aligned with the speculum.

1. Hold the handle of the otoscope in your dominant hand. If the client is restless, hold the otoscope handle upward, resting the hand against the client's head. If the client is cooperative, hold the handle downward.
2. For adult clients, grasp the superior portion of the auricle and pull up, out, and back to straighten the auditory canal. (See the accompanying figure.)
3. Insert the speculum into the ear and advance it gently. Assess the walls of the auditory canal while advancing the speculum, inspecting for color, obstructions, hair growth, and cerumen. Old cerumen is very dark and may obstruct visualization of part or all of the tympanic membrane.

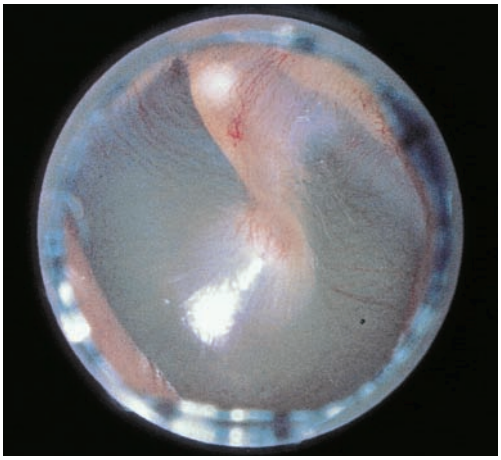


An otoscope.

Technique for using an otoscope.

BOX 47–2 Guidelines for Using the Otoscope (continued)

4. Move the otoscope so that you can see the tympanic membrane. You may need to realign the auditory canal by gently continuing to pull up and back on the auricle. A normal membrane is semitransparent, allowing visualization of a portion of the auditory ossicles. The concave nature of the tympanic membrane and its oblique position in the auditory canal account for the triangular light reflex (cone of light) seen on otoscopic examination.
5. Note the color and surface of the membrane. The normal tympanic membrane is pearly gray, shiny, and semitransparent. The surface should be continuous, intact, and either flat or concave.
6. Identify the landmarks on the tympanic membrane (see the accompanying figure):
   a. The cone of light, located over the anteroinferior quadrant.
   b. The malleus, pars tensa, annulus, pars flaccida, and malleolar folds.
7. Assess movement of the tympanic membrane. If the auditory tube is patent, the membrane moves in and out when air is injected (or when the client performs the Valsalva maneuver).



Structures of the tympanic membrane visible through the otoscope.

8. Gently withdraw the speculum. If the speculum is soiled with drainage or cerumen, use a clean speculum for the other ear.
9. Using the same technique, examine the other ear.

EAR AND HEARING ASSESSMENTS

Hearing Assessment

Tuning forks are used to determine whether a hearing loss is conductive or perceptive (sensorineural). Hold the tuning fork at the base and make it ring softly by stroking the prongs or by lightly tapping them on the heel of the opposite hand. The vibrating tuning fork emits sound waves of a particular frequency, measured in hertz (Hz). Tuning forks with a frequency of 512 to 1024 Hz are preferred for auditory evaluation, because that range corresponds to the range of normal speech.

Technique/Normal Findings	Abnormal Findings
Perform the Weber test. Place the base of a vibrating tuning fork on the midline vertex of the client's head (Figure 47–11 ■). Ask whether the client hears the sound equally in both ears or better in one than the other. *Sound is normally heard equally in both ears.*	■ Sound heard in, or lateralized to, one ear indicates either a conductive loss in that ear or a sensorineural loss in the other ear. The sound will be louder on the impaired side with a conductive hearing loss. The sound will be softer on the impaired side with a sensorineural hearing loss. Conductive losses may be due to a buildup of cerumen, an infection such as otitis media, or perforation of the eardrum.

Figure 47–11 ■ Performing the Weber test with a tuning fork.

Technique/Normal Findings	Abnormal Findings
Perform the Rinne test. Place the base of a vibrating tuning fork on the client's mastoid bone. Ask the client to indicate when the sound is no longer heard. When the client does so, quickly reposition the tuning fork in front of the client's ear close to the ear canal. Ask whether the client can hear the sound. If the client says yes, ask the client to indicate when the sound is no longer heard. Repeat over the opposite mastoid bone (Figure 47–12 ■). *The client with no conductive hearing loss will hear the sound twice as long by air conduction as by bone conduction .*	■ Bone conduction is greater than air conduction in the ear with a conductive loss. The normal pattern is AC > BC (air conduction greater than bone conduction).
Perform the whisper test. Ask the client to occlude one ear with a finger. Stand 1 to 2 feet away from the client, on the side of the unoccluded ear. Softly whisper numbers and ask the client to repeat them. Repeat the procedure, having the client occlude the other ear. Note whether you need to raise your voice or to stand closer to make the client hear you.	■ This test provides a rough estimate of hearing loss.
Use a tympanogram to measure the pressure of the middle ear and observe the tympanic membrane's response to waves of pressure. Insert the device into the ear canal. Ask the client not to speak, move, swallow, or jump when hearing a sound. Tell the client he or she will hear a loud tone as the measurements are taken. The normal pressure inside the middle ear is a 100 daPa (a very small amount). Repeat for the other ear.	■ Abnormal findings may include fluid in the middle ear, a perforated eardrum, impacted earwax, or a tumor of the middle ear.

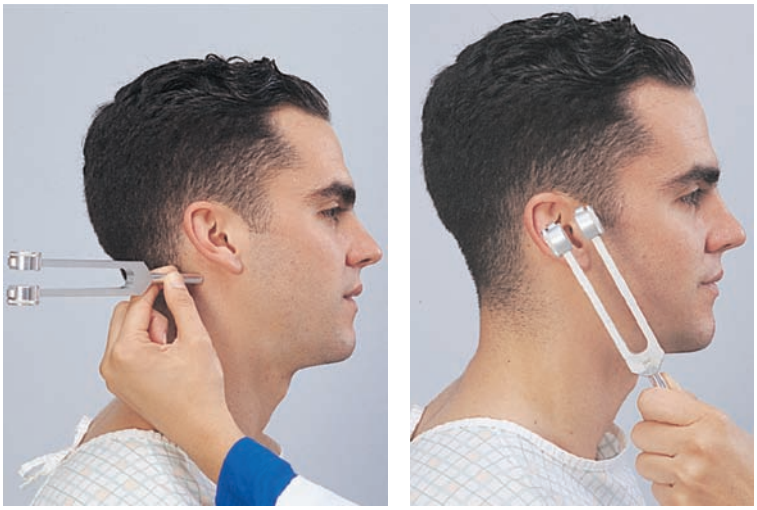


Figure 47–12 ■ Performing the Rinne test with a tuning fork.

External Ear Assessment

Inspect the auricle. *External ears are normally bilaterally equal in size, of equal color with the client's face, without redness or lesions.*	■ Unusual redness or drainage may indicate an inflammatory response to infection or trauma. ■ Scales or skin lesions around the rim of the auricle may indicate skin cancer. ■ Small, raised lesions on the rim of the ear are known as tophi and indicate gout.

Technique/Normal Findings	Abnormal Findings
Inspect the external auditory canal with the otoscope. *Canal walls should be pink and smooth without lesions. Cerumen is normally present in small, odorless amounts.*	■ Unusual redness, lesions, or purulent drainage may indicate an infection. ■ Cerumen varies in color and texture, but hardened, dry, or foul-smelling cerumen may indicate an infection or an impaction of cerumen that requires removal. People with darker skin tend to have darker cerumen.
Inspect the tympanic membrane. *The tympanic membrane should be pearly gray, shiny, and translucent without bulging or retraction.*	■ White, opaque areas on the tympanic membrane are often scars from previous perforations (Figure 47–13 ■). ■ Inconsistent texture and color may be due to scarring from previous perforations caused by infection, allergies, or trauma. ■ Bulging membranes are indicated by a loss of bony landmarks and a distorted light reflex. Such bulges may be the result of otitis media or malfunctioning auditory tubes. ■ Retracted tympanic membranes are indicated by accentuated bony landmarks and a distorted light reflex. Such retraction is often due to an obstructed auditory tube.
Palpate the auricles and over each mastoid process. *There should be no pain or swelling on palpation.*	■ Tenderness, swelling, or nodules may indicate inflammation of the external auditory canal or mastoiditis.

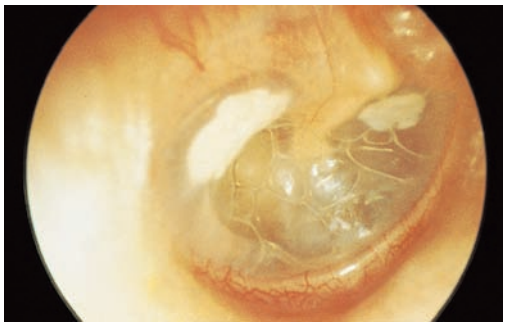


Figure 47–13 ■ Scarring of the tympanic membrane.

Source: Professor Tony Wright, Institute of Laryngology and Otology/SPL/Photo Researchers, Inc.

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Care Plan Activity: Ear Pain
Case Studies
Identifying Common Pathologies
Otitis Media
MediaLink Applications: Nystagmus
Links to Resources

TEST YOURSELF NCLEX-RN® REVIEW

1 During an eye assessment, you touch the part of the eye covering the iris and pupil. What normal client response would you expect?
1. excess tearing
2. blinking of eyelids
3. bilateral nystagmus
4. pupil dilates

2 Which of the following statements would indicate a client has presbyopia?
1. "I just am having so much trouble hearing music."
2. "I can't seem to remember anything these days."
3. "I think I have a lot of earwax in my ears."
4. "My arms just don't seem long enough to read."

3 What equipment would be necessary to test sound conduction during an assessment of the ear?
1. ophthalmoscope
2. tuning fork
3. otoscope
4. penlight

4 What occurs when light enters the lens of the eye?
1. accommodation
2. convergence
3. pupillary reflex
4. hyperopia

5 What would you tell a client before a test of refraction is done?
1. "This test is uncomfortable, but it doesn't take long."
2. "You will be blindfolded during the test."
3. "Are you allergic to seafood?"
4. "Your pupils will be dilated for several hours."

6 What function, in addition to hearing, is provided by the inner ear?
1. Coordinates visual pathways.
2. Integrates efferent neuron messages.
3. Provides information about head position.
4. Maintains middle ear structure and function.

7 Why is the Snellen eye chart used during vision assessment?
1. to test distant vision
2. to test near vision
3. to determine visual fields
4. to examine convergence

8 Of the following ear assessments, which one is a rough estimate of the ability to hear?
1. whisper test
2. Rinne test
3. Weber test
4. audiometry

9 What is a high-priority risk for the older adult with age-related changes in the vestibular structures of the ear?
1. infection
2. falls
3. medication errors
4. food intolerance

10 Which criterion is important to accurately assess visual fields?
1. Client must wear corrective lenses.
2. Client must have no less than 20/30 vision.
3. Examiner must not wear glasses.
4. Examiner must have normal visual field.

See Test Yourself answers in Appendix C.

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