

Component III: Clinical

Module B: Specialty Procedures

Topic 2 Audiometry Screening

Statement of Purpose

To provide learner with basic understanding of skills necessary to perform auditory testing that clinicians order to help with the diagnosis and treatment associated with the ear or ears of patients.

Student Learning Outcomes

Upon completion of this topic, the learner will be able to:

1. Spell and define the key terms.
2. Review the anatomy of the ear.
3. Differentiate between conductive and sensory hearing loss.
4. Describe screening for auditory acuity using the audiometer.
5. List and describe the controls and switches on the audiometer.
6. List various guidelines for audiometric testing.
7. List common behaviors that might indicate a hearing loss.
8. Document accurately.

Terminology

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| 1. Audiometer | 12. Malleus |
| 2. Audiometric | 13. Meniere's Disease |
| 3. Auricle | 14. Ossicles |
| 4. Cerumen | 15. Otitis externa |
| 5. Child Health and Disability Prevention (CHDP) | 16. Otitis media |
| 6. Cochlea | 17. Otosclerosis |
| 7. Conduction hearing loss | 18. Presbycusis |
| 8. Decibels (dB) | 19. Sensory |
| 9. Eustachian tube | 20. Stapes |
| 10. Hertz or cycles per second (Hz) | 21. Tinnitus |
| 11. Incus | 22. Vestibular mechanism |

References

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Content Outline/Theory Objectives	Suggested Learning Activities
<p>Objective 1 Spell and define key terms.</p> <ul style="list-style-type: none"> A. Review the terms listed in the terminology section. B. Spell the terms listed accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context. 	<ul style="list-style-type: none"> A. Games: word searches, crossword puzzles, Family Feud, Jeopardy, bingo, spelling bee, hangman, and concentration. B. Administer vocabulary pre-test and post-test. C. Discuss learning gaps and plan for applying vocabulary.
<p>Objective 2 Review the anatomy of the ear.</p> <ul style="list-style-type: none"> A. External ear <ul style="list-style-type: none"> 1. Auricle or pinna <ul style="list-style-type: none"> a. Visible portion of the external ear. b. Funnel for sound from environment into external auditory canal. 2. External auditory canal <ul style="list-style-type: none"> a. Slightly curved, approximate length 1¼ inches and diameter ¼ inches. b. Function to carry sound to the tympanic membrane. c. Composed of hair follicles, sweat glands and oil glands. d. Function of oil glands is to produce wax (cerumen.) B. Middle ear <ul style="list-style-type: none"> 1. Air-filled cavity. 2. Location of ossicles <ul style="list-style-type: none"> a. Malleus. b. Incus. c. Stapes. 3. Function to transfer vibration/sound waves from the eardrum to ossicles to cochlea. 4. Eustachian tube <ul style="list-style-type: none"> a. Opens to middle ear. b. Functions to equalize pressure within the inner ear and the environment. 5. Inner ear composed of two sensory organs <ul style="list-style-type: none"> a. Vestibular mechanism, organ for balance b. Cochlea <ul style="list-style-type: none"> 1) Organ for hearing. 2) Contains thousands of microscopic hairs that detect fluid movements within the inner ear. C. Auditory nervous system 	<ul style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings C. Have students screen one another using an audiometer. D. Hold a pediatric day and have students invite friends with children or family members to attend class and have their hearing screened.

<ol style="list-style-type: none"> 1. Composed of the eighth cranial nerve and its associated pathways to the brain. 2. Sound travels from auditory nerve to the brain stem and then to the temporal lobe of brain. 	
<p>Objective 3 Differentiate between conductive and sensory hearing loss.</p> <p>A. Conductive hearing loss</p> <ol style="list-style-type: none"> 1. Malfunction of the external and/or middle ear while inner ear and nerve are normal. 2. Reduction in sound volume conveyed or conducted to the inner ear. 3. Variety of symptoms related to degree of hearing loss <ol style="list-style-type: none"> a. Hearing loss predominately in the low frequencies or equally in all frequencies. b. Speech understood if loudness of speaker is increased. c. Usually not annoyed by loud sounds. d. Hears own voice as loud, speaks in soft voice. 4. Cause described according to part of hearing mechanism affected <ol style="list-style-type: none"> a. Absence or malformation of pinna and external auditory canal. b. Obstruction of the external auditory canal <ol style="list-style-type: none"> 1) Foreign object. 2) Build-up of cerumen. c. Inflammation or infection of middle ear. d. Perforation of the tympanic membrane. e. Otosclerosis. f. Usually correctable with medication or surgery. <p>B. Sensory neural hearing loss</p> <ol style="list-style-type: none"> 1. Malfunction of the inner ear and/or auditory nerve. 2. Reduction in sound volume and loss of speech clarity. 3. Symptoms vary with severity and location of problem/cause <ol style="list-style-type: none"> a. Loss possibly greater for the higher frequency sounds. b. Reduced ability to understand speech. c. Possibly unable to tolerate loud sounds. d. Unable to hear own speech; speaks in loud voice. e. Complaints of ringing or buzzing sounds in ears. 4. Causes <ol style="list-style-type: none"> a. Congenital hearing loss. b. Acquired hearing loss <ol style="list-style-type: none"> 1) Six out of 1,000 normal births will 	<p>A. Lecture/Discussion B. Assigned Readings</p>

<p>have sensory neural hearing loss.</p> <ol style="list-style-type: none"> 2) One out of 1,000 normal births will be deaf due to sensory neural hearing loss. 3) Usually not correctable with medication or surgery. <p>C. Mixed hearing loss, combination of conductive and sensory neural hearing loss.</p>	
<p>Objective 4 Describe screening for auditory acuity using the audiometer.</p> <ol style="list-style-type: none"> A. Use audiometer manufactured to meet specifications described by the American National Standards Institute. B. Each audiometer must be calibrated annually, be alternating current (AC) powered and have the minimum ability to: <ol style="list-style-type: none"> 1. Produce intensities between 0-80 dB. 2. Produce frequencies 1000, 2000 and 4000 Hz. 3. Have an adjustable headset with right and left earphones. 4. Operate manually. 	<ol style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings C. Demonstrate equipment

Objective 5**List and describe the controls and switches on the audiometer.**

- A. Power source, the “on” and “off” control.
- B. Ear selector control
 - 1. Knob or switch that allows operator to direct the pure tone to one or the other earphones.
 - 2. Right is Red. Left is Blue.
 - 3. Frequency selector dial
 - a. Dial indicates the frequencies (pure tone).
 - b. Examples include 250, 500, 1000, 2000, 3000, 4000, 6000 Hz. (Hertz or cycles per second.)
- C. Intensity (attenuator) dial
 - 1. This controls the “loudness” or intensity of the tone.
 - 2. It is calibrated to produce levels in 5 decibels (dB) increments. i.e. 0, 5, 10, 15, etc.
 - 3. Normal ear can barely detect “0” on any of the frequencies or pure tones.
- D. Interrupter switch or tone control switch
 - 1. Button or switch is used to present the tone.
 - 2. Tone should be audible only when the control is activated.
- E. Earphones and headband
 - 1. Red earphone goes to right ear and blue earphone goes to left ear.
 - 2. Ear pads/muffs should not be too large (i.e., audio cup used with sound systems.)

- A. Lecture/Discussion
- B. Assigned Readings
- C. Demonstrate equipment
- D. When possible allow time for return demonstration and practice

Objective 6**List various guidelines for audiometric testing.**

- A. Qualifications of personnel performing an audiometric screening require completion of training course.
- B. Audiometric testing
 - 1. Use a pure tone audiometer.
 - 2. Test the audiometer each day prior to use to make sure it is working properly.
 - 3. Assess the testing room for noise level prior to starting the testing procedure.
 - 4. Person with normal hearing should put the earphones on and be able to hear each frequency at 15 dB.
 - 5. Cover both ears with audiometer earphones.
- C. Give age-appropriate directions to determine if person being tested can hear sound
 - 1. Adults can raise a finger, a hand or an arm.
 - 2. Children can be given blocks to put into a basket when tone is heard.

- A. Lecture/Discussion
- B. Assigned Readings

<p>D. Allow patient to identify sounds before test begins</p> <ol style="list-style-type: none"> 1. Dial intensity to 50 dB. 2. Without applying earphones, press intensity dial. <p>E. Before beginning test, explain to patient how he/she will let operator know that tone is heard. Check for understanding.</p> <ol style="list-style-type: none"> 1. Operator must be positioned in a manner that patient cannot see when/if interrupter switch is being activated. 2. Operator should make absolutely no movement with body or with facial expressions when interrupter switch is being activated. 3. If a young child is being tested, remember that the usual attention span of children is three minutes. The test should be completed within this time frame. 4. Dial intensity to 25 dB. 5. Properly place the earphones on patient <ol style="list-style-type: none"> a. Remove eyeglasses from adults. Do not take a child's eyeglasses for fear he/she may be uncomfortable if not able to see environment clearly. b. Grasp earphones by pads. c. Position fingers towards the back of earphones. This enables operator to push hair away from face. 6. Start by testing the right ear first. Place the ear selector switch to right ear. 7. Dial intensity to 25 dB and frequency at 1000. Push the interrupter switch and wait for response. Increase frequency to 2000, then 3000, and finally to 4000 Hz. Wait for response after each increase. 8. Change ear selector switch to left ear and repeat the procedure at frequencies from 4,000, 3,000, 2,000, and 1,000. 9. Do not be consistent with the amount of time that elapses between sounds. This might cue the patient to respond in a rhythmical manner when no sound is heard. 10. Hold the interrupter switch down for the same amount of time each time. A rule of thumb is to say "one Mississippi" to yourself. 11. If there is no response, switch to the opposite ear and test it at 50 dB. If that is heard, switch ears again and try the 50 dB range in that ear. 12. Document results on the response/no response audiogram approved for Child Health and Disability Prevention (CHDP). 13. Do not use the standard graphic method provided by the manufacturer 	
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<ul style="list-style-type: none"> a. Should be used only by an audiologist. b. Is used for diagnostic/threshold test. c. Takes at least one hour to complete properly. d. Utilizes all dB. When sounds louder than 35 dB are made, the sounds will cross over and be heard in the opposite ear. 	
<p>Objective 7 List common behaviors that might indicate a hearing loss.</p> <ul style="list-style-type: none"> A. Frequent requests that speaker repeat what has been said. B. Inappropriately loud when speaking <ul style="list-style-type: none"> 1. Possible sensory neural hearing loss. 2. Possible high frequency hearing loss. C. Inappropriately soft when speaking <ul style="list-style-type: none"> 1. Possible conduction hearing loss. 2. Possible low frequency hearing loss. D. No response when spoken to or responds only when spoken to in a loud voice <ul style="list-style-type: none"> 1. Possible hearing loss. 2. Possible problems with central auditory processing. E. Failure to track sounds with eyes/head. F. Normal development <ul style="list-style-type: none"> 1. By 3 months of age <ul style="list-style-type: none"> a. Startled by loud sounds. b. Respond to familiar voices. 2. By 6 months of age <ul style="list-style-type: none"> a. Smile when spoken to. b. Vocalize or babble. 3. By 9 months of age <ul style="list-style-type: none"> a. Localize to speech or environmental sounds. b. Become attentive to music or singing. 4. By 12 months of age <ul style="list-style-type: none"> a. Babble using various sounds and multiple syllables. b. Look at familiar objects or people when named. 5. By 18 months of age <ul style="list-style-type: none"> a. Say single words. b. Understand approximately 50 words. 6. By 24 months of age <ul style="list-style-type: none"> a. Follow simple commands such as “no” and “sit down.” b. Have a vocabulary of at least 50 words. c. Say two-word phrases. d. Speak intelligibly at least 50 percent of the time. 7. By 36 months of age 	<ul style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings

<ul style="list-style-type: none"> a. Follow more complex commands such as "sit down and drink your juice." b. Have a vocabulary of 300 words or more. c. Say three word simple sentences. d. Speak intelligibly 75 percent of the time. <p>G. Does not pronounce words well</p> <ul style="list-style-type: none"> 1. Vowel sounds are identified with low frequency tones. 2. In low frequency loss, speech lacks proper vowel formation/pronunciation. 3. Consonant sounds are identified in high frequency tones. 4. In high frequency loss, speech lacks proper consonant formation/pronunciation. 	
<p>Objective 8 Document accurately.</p> <ul style="list-style-type: none"> A. If using standard audiogram graphic method <ul style="list-style-type: none"> 1. "O" indicates right ear. 2. "X" indicates left ear. B. If using the recommended response/no response audiogram <ul style="list-style-type: none"> 1. Check mark indicates a response at a level not exceeding 25 dB. 2. Straight line, such as a hyphen, indicates that there was no response at the screening level. C. Document date and time of audiometric screen in chart <ul style="list-style-type: none"> 1. Time becomes important if there is a hearing loss. 2. People being tested after activities that involve loud noise may present with a temporary loss <ul style="list-style-type: none"> a. Due to the bending action of the hair like structures in the cochlea. b. Such activities may include band practice, school, or work environment. 	<ul style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings C. Practice recording results