

CARL

Lesson Plan – Intro to Audiometry and Occupational Hearing

Lesson Overview

Using CARL for this lesson reduces costs of replacement foam tips, specula, earplugs and infection control products.

CARL also is a great way to teach hearing screeners and novice clinicians how to work around patients without discomfort.

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- This activity allows trainees unfamiliar with audiological testing to practice placing headphones, inserting foam insert tips and completing the physical components of otoscopy properly on CARL.
 - Trainees will be able to practice placing an otoscope into an ear using the proper force and bracing technique.
 - Trainees will be able to adjust the headphone bands, ensure they are placed on the correct ears, ensure proper foam tip insertion, and practice placing a bone conductor headphone.
 - Trainees will be able to practice giving instructions to CARL for otoscopy and audiometry
 - Trainees will be able to practice inserting and placing noise protection and discuss considerations for use of hearing protection with other protective gear.
 - This lesson is appropriate for first time audiology and hearing instrument specialist students as well as speech language pathologists, occupational nurses, hearing science and psychology students who will be screening hearing.

Lesson Prep

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- Prepare a script for trainees on instructions they are to give CARL prior to otoscopy
 - Prepare a script for trainees on instructions they are to give CARL for each of the headphones
 - Obtain headphones used at your facility
 - If teaching infection control review relevant infection control guidelines. Bring cleaning supplies for headphones to demonstrate.
 - If working with noise protection, bring different ear plugs as well as a selection of relevant protective gear such as safety goggles and hardhats.

Part One:

Otoscopy

Otoscopy:

Lesson

Extensions

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- This lesson can be used as an introductory lab for practice as well as a starting point to discuss a broader range of topics related to otoscopy such as:
 - External ear canal pathologies
 - Foreign bodies in the external ear canal
 - Cerumen management
 - Ear impressions

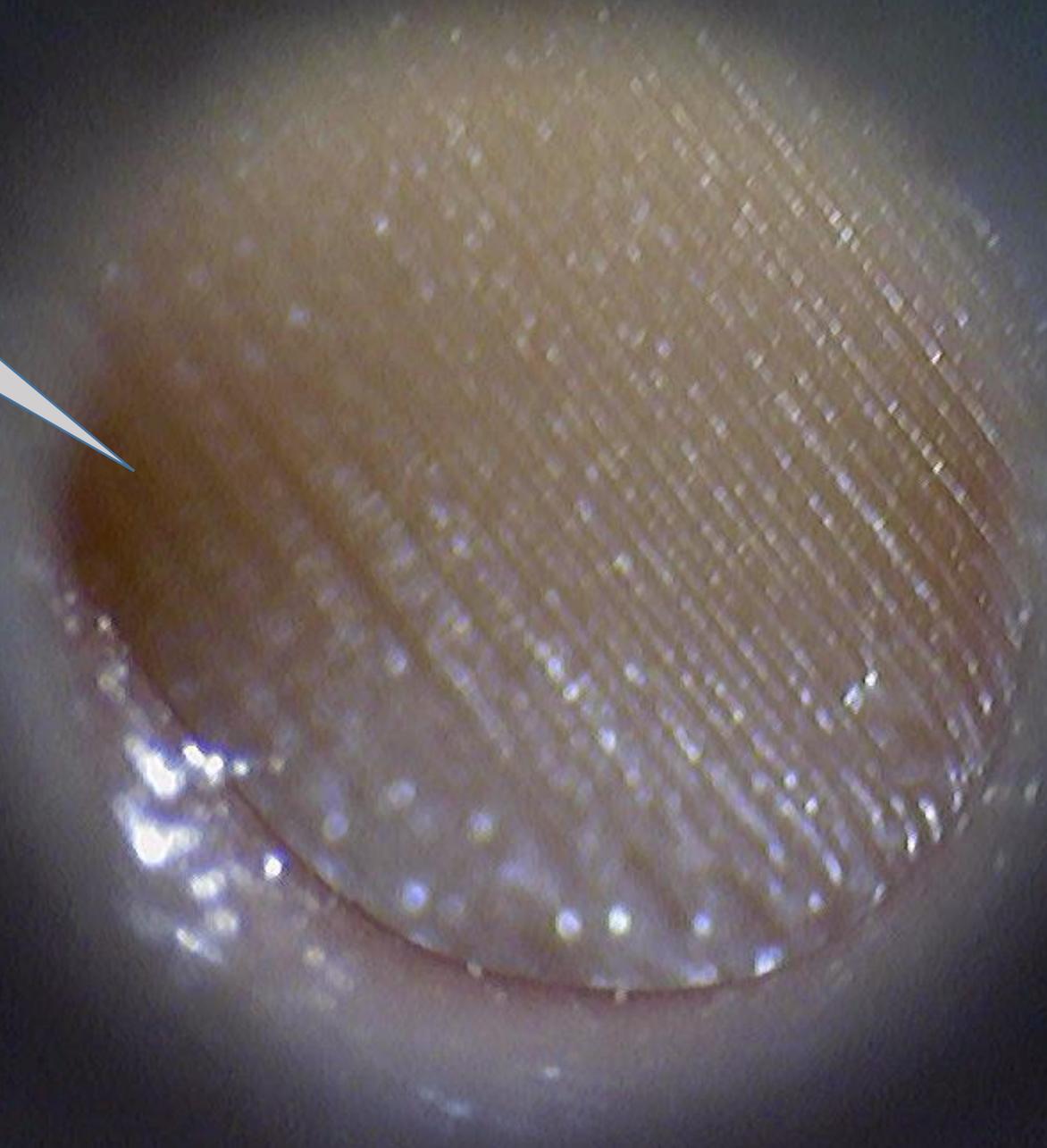
Part One: Otoscopy



Steps for Clinical Otoscopy

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- Choose the appropriate specula for the otoscope. For the best view of the tympanic membrane, choose the largest specula that will fit comfortably in your patient's ear.
 - Let the patient know what you are doing by reading the Otoscopy Script
 - Gently pull CARL's ear up and back to straighten the ear canal so that the tympanic membrane can be viewed.
 - Using the same hand that is holding the otoscope brace one or two fingers against the jawline in case of sudden movements.
 - Gently move the otoscope into the proper position to see the ear canal and tympanic membrane
 - Now do the other ear. It is necessary to practice with BOTH ears as you will hold the otoscope in the right hand for the right ear and the left and for the left ear. This takes practice – but that's what CARL is here for.

A view of Carl's tympanic membrane through the video otoscope



Part Two:
Headphones
for
Audiometry

Headphones:

Lesson

Extensions

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- This lesson can be used as an introductory lab for practice as well as a starting point to discuss a broader range of headphone related topics such as:
 - Interaural attenuation and masking
 - Maximum Permissible Ambient Noise Levels
 - Infection control
 - Occupational and community-based hearing screening equipment.
 - Evaluation of less expensive alternatives to traditional headphones.

Introduction:

Headphone Types

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- During audiometry, sounds are presented to the patient via different types of headphones.
 - In this lab, you will become familiar with the headphones, what they test, and how to properly place the headphones on the patient.
 - We will discuss when each type of headphone is used and why.
 - We will also discuss how to clean the headphones after each patient.

TDH Headphones

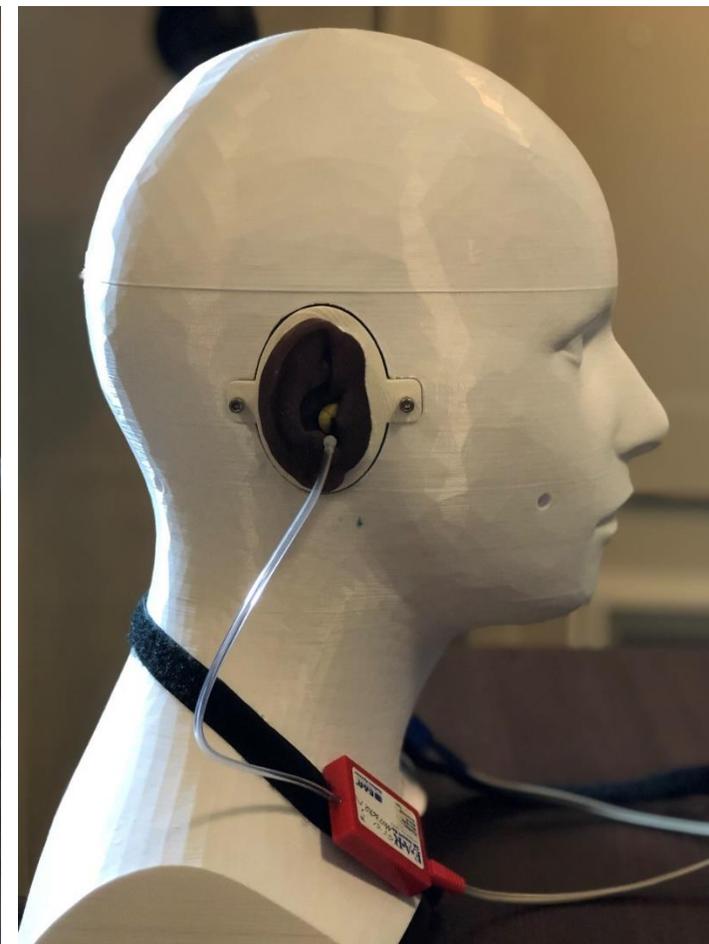
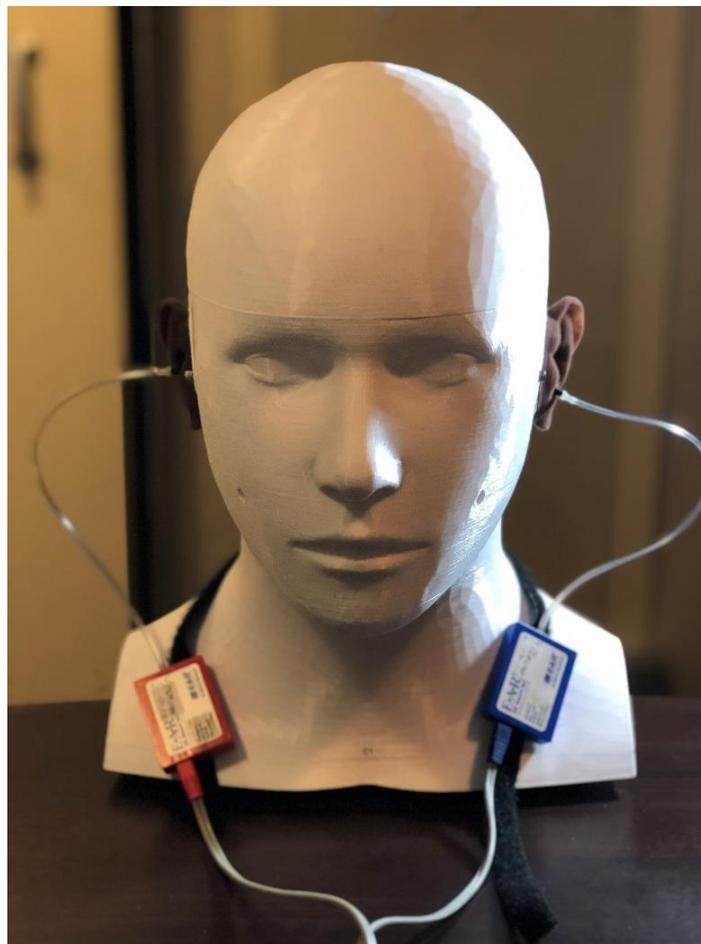


TDH 30

- This type of headphone rests on CARL's ears and is classified as a supra-aural headphone.
- Supra-aural headphones should be wiped clean using the product specified in your infection control guideline and allowed to dry completely or covered in a new set of earphone covers between patients.

Pros	Cons
Come standard with most audiometers	May be uncomfortable
Less expensive than replacement foam tips	Does not block out noise as well as other headphones/inserts
Easy to use	Poorer interaural attenuation
	May cause collapsed canals during testing
	Less reliable for test-retest of 6-8 kHz.

ER3A – Insert Phones



ER3A Insert

- The foam tip of this earphone is inserted into CARL's ears and is classified as an insert earphone.
- The foam-tips are single use and should be thrown away after each patient.

Pros	Cons
Come standard with most audiometers	Higher cost of replacement foam tips
Avoids collapsed canals	
Better interaural attenuation	
Blocks out noise better than TDH	



Circumaural Headphones

Circumaural Headphones

- The Sennheiser HDA 300, Sennheiser 200 HDA, Sennheiser HD280Pro and DD450 are all types of circumaural headphones.
- Compare how these fit around CARL's ears compared to the TDH headphones which rest on top of his ears.
- Circumaural headphones can be used for high frequency threshold testing and with several tablet-based audiometers such as Shoebox and HearX
- These headphones should be wiped clean using the product specified in your infection control guideline and allowed to dry completely or covered in a new set of earphone covers between patients.

Pros (type specific)	Cons (type specific)
Blocks out noise well	May be expensive (depending on type)
May test high frequencies up to 20 kHz	May be heavy
Comes with some portable hearing test systems	

Bone Conductor

- Unlike the previous headphones, the bone conductor rests behind CARL's ear. On a patient, this would sit on the mastoid bone. The bone conductor test determines the type of hearing loss found by the air conduction testing.
- Sounds bypass the outer and middle ear and test the inner ear for hearing.



Part Three:
Hearing
Protection

Hearing Protection:

Lesson Extensions

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- This lesson can be used as an introductory lab for practice as well as a starting point to discuss a broader range of occupational noise and hearing conservation related topics such as:
 - Pros and cons of each type of type of hearing protection device.
 - Occupational noise exposure level standards
 - NRR: Noise Reduction Ratings
 - ANSI (ANSI/ASA S12.6-2016) and ISO (4869-1:2002) standards for evaluating hearing protection

Noise Protectors



- In this section different hearing protection headphones and earplugs can be introduced
- Proper insertion and use of hearing protection should be discussed.
- Custom hearing protection can be made for CARL in advance by taking impressions of his ears.
- Considerations for hearing protection worn with other protective gear can be presented.
- NRR ratings and relevant occupational standards for exposure to noise should be introduced.

Evaluating Competencies

At the end of this lesson trainees should be able to:

- Insert the otoscope gently
- Competently use a bracing technique during otoscopy for both the left and right hands
- Identify a foreign object placed in CARL's ear canal
- Identify the headphone types correctly
- Place headphone correctly for headband size, positioning and correct ear
- Insert foam tip of ER3A into ear correctly and into the correct ear
- Place the bone conductor on CARL
- Insert hearing protection properly
- Discuss noise protection considerations
- Discuss proper infection control protocols

Resources

Headphones (Traditional)

Handbook of clinical audiology/ editor-in-chief, Jack Katz, editors, Marshall Chasin, Kristina English, Linda J. Hood, Kim L. Tillery. – Seventh edition (2015).

- Section 1 Basic Tests and Procedures: Equipment Transducers pp: 32-33

Headphones (Alternative)

- Folkeard, P., Hawkins, M., Scollie, S, Sheikh, B. & Parsa, V. (2019). An evaluation of the Sennheiser HDA 280-cL circumaural headphone for use in audiometric testing. IJA, 58(7), 427-433. doi.org/10.1080/14992027.2019.1594415
- Smull, C.C., Madsen, B. & Magolis, R.H. (2019). Evaluation of two circumaural earphones for audiometry. Ear and Hearing, 40(1), 177-183. <http://doi.org/10.1097/AUD.0000000000000585><http://doi.org/10.1097/A>
- Van der Aerschot, M., Swanepoel, D.W., Mahomed-Asmail, F, Myburgh, H.C. & Eikelboom, R.H. (2016). Affordable headphones for accessible screening audiometry: an evaluation of the Sennheiser HD202II supra-aural headphone. IJA, 55(11), 616-622. doi.org/10.1080/14992027.2016.1214756

Standards

Handbook of clinical audiology/ editor-in-chief, Jack Katz, editors, Marshall Chasin, Kristina English, Linda J. Hood, Kim L. Tillery. – Seventh edition (2015).

- ANSI, IEC and ISO Standards Table 2.1. p.11

Resources

Otoscopy

Diagnostic Examples:

<http://diagnosis101.welchallyn.com/otoscopy/educational-topics/ear-pathologies/>

Hearing Conservation and Occupational Noise

- The Occupational Safety and Health Administration is an excellent resource and provides information on Standards, Health Effects of Noise, Exposure & Controls, Hearing Conservation Programs, and Hearing Loss in Construction. It also has links to many additional resources.
- <https://www.osha.gov/SLTC/noisehearingconservation/>

Resources

Infection Control:

Infection Control guidelines may vary in different areas and local and up-to-date preferred practice guidelines should be taught

Instructors not familiar with infection control should become familiar with the regulations for their area and could register for overview information presented by audiologyonline on this topic such as:

<https://www.audiologyonline.com/audiology-ceus/course/infection-control-current-trends-for-29121>

Or review

Chapter 46 Infection Control by AU Bankaitis in Handbook of clinical audiology/ editor-in-chief, Jack Katz, editors, Marshall Chasin, Kristina English, Linda J. Hood, Kim L. Tillery. – Seventh edition (2015). pp: 861-868