

CARL
EARMOLD IMPRESSIONS
WORKBOOK



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WELCOME!

A LITTLE ABOUT CARL

In 2015, CARL began as an engineering research project at Western University to provide better experiential training in the audiology program.

From 2016 to 2018, CARL prototypes underwent multiple upgrades and validations studies were completed with excellent results.

In 2018, Ahead Simulations was established.

CARL was officially launched to international markets in 2019. CARL found new use cases, new lesson plans, and a whole new range of anatomies, functionalities, and improvements. CARL attended international conferences, and 50 CARL units found homes in 7 different countries around the world.

After a turbulent beginning to 2020 and the worldwide health crisis, CARL has adapted to allow safe hands-on training while social distancing. CARL is continuing to expand with new lesson plans, new features, new sites, and new ways of accessing CARL.

The uses for CARL are countless and include: otoscopy, cerumen management, real-ear verification measures (e.g. BiCROS, CROS), earmold impressions, hearing aid fittings, custom molds (i.e. hearing aid, noise, swim, musician, and sleep), fitting of other hearing protection devices (HPD's), placement of inserts and headphones, proper placement of impedance tip, and more!

The following is a guide with information and exercises to assist you in developing your cerumen management knowledge and skills.

This manual was designed to supplement your course material and is not exhaustive of all earmold impression information.

If you require assistance you can contact Ahead support at support@aheadsimulations.com.

Enjoy your CARL experience!

Ahead Team



EARMOLD IMPRESSIONS

GETTING STARTED

Lesson Overview:

Earmold impressions using CARL:

- Provides a safe practicing environment which allows the student clinician to become more **comfortable** and **experienced**
- Increases the amount of training and experience clinicians have which can **strengthen** their skills
- Allows student clinicians to work **independently** without the need for direct supervision
- Allows students to take **ownership** of their learning and **reflect** on the skills that need to be improved
- Promotes continued **development** of the essential skills and attributes required in healthcare
- Provides **unlimited** learning since CARL never gets tired and is always available
- **Reduces** the need for infection control products

Lesson Objectives:

Student clinicians will:

- Obtain consent by providing information regarding the nature, benefits, risks, alternatives, and consequences of earmold impressions
- Improve critical thinking skills to determine best outcome with minimal risk of harm
- Practice proper force and bracing techniques involved with otoscopy and earmold impressions
- Identify the materials and equipment used for earmold impressions
- Develop earmold impression techniques
- Examine earmold impressions to determine suitability
- Create comprehensive chart-notes based on session

Lesson Prep:

REVIEW

- Prepare scripts for student clinicians on instructions they are to give to CARL for otoscopy and earmold impressions
- Review: earmold impression materials and equipment, infection control guidelines, ear anatomy, earmold styles and materials (i.e. skeleton, lucite, etc.), obtaining a thorough case history including modifying factors, ordering custom products (i.e. completing order form), potential risks of harm, emergency protocols, government regulations, and regulatory college practice standards and regulations including professional liability insurance

OTHER RELEVANT LESSONS

- For practice using an otoscope refer to the lesson: Intro to Audiometry and Occupational Hearing
- For practice removing simulated cerumen refer to the lesson: Cerumen Management

Materials and Equipment:

- | | |
|----------------------------------------------|-------------------------------|
| • CARL | • Mixing spatula |
| • CARL earmold impression ears | • Impression material |
| • CARL Patient Chart | • Selection of otoblocks/dams |
| • Illumination using different light sources | ○ Cotton |
| ○ Otoscope | ○ Foam |
| ○ Electric headlight | • Impression syringes |
| ○ Video otoscope | • Impression gun |
| ○ Operating microscope | ○ Cartridges |
| • Aural specula | ○ Tips |
| • Earlight/Penlight with tip | • Impression box |

Lesson Extensions

- Simulated cerumen management
- Real-ear measures
- Over-the-counter (OTC) cerumen management
 - Example: cotton swabs, Earigate, ear bulb syringe
- Foreign body extraction (i.e. hearing aid dome, hearing aid battery, cotton swab tip)
- Proper fit, insertion, and removal of hearing aids, earmolds (i.e. hearing aid, noise, swim, musician, and sleep)

Remote Learning/ Additional Practice

- Students can continue to improve their skills anywhere using the AEar
- Students can practice:
 - Otoscopy
 - Cerumen management
 - Probe tube placement
 - Hearing aid physical fit
 - Earmold impressions
 - Custom and non-custom earmold fit
 - Foreign-body extraction
- Additional hands-on learning
- Contact info@aheadsimulations.com



*Materials not included

INTRODUCTION TO EARMOLD IMPRESSIONS: A BRIEF OVERVIEW


- Earmold impressions are a cast of the outer ear
- Earmold impressions can be used for various purposes including hearing aids, sleep plugs, hearing protection, pressure equalizing plugs, musician plugs, swimming plugs, communication devices, and in-ear monitor

- Important part of the services hearing health providers offer
- Importance of a good impression:
 - less chance for remake
 - patient satisfaction
 - shows direction of the ear drum
 - better retention
 - less chance for feedback
 - aesthetics
 - demonstrate professional skills

Considerations Prior to Earmold Impressions:

Case History	End User	End Use	Impression Characteristics	Impression material
<ul style="list-style-type: none"> •Medications •Medical conditions •Previous experience •Other considerations (i.e. dexterity) 	<ul style="list-style-type: none"> •Adult •Pediatric 	<ul style="list-style-type: none"> •Custom hearing aid •CIC or IIC •Mold for BTE or RITE •Other custom product •High-gain hearing device 	<ul style="list-style-type: none"> •Depth required •Open jawed •Closed jawed 	<ul style="list-style-type: none"> •Type •Shore •Viscosity •Stress Relaxation •Contraction Ratio •Tensile Strength

Open vs. Closed-Jaw Impressions

Open	Closed
<ul style="list-style-type: none"> • Deep seated hearing aids (i.e. CIC) • Dental/Jaw considerations (i.e. missing back teeth, TMJD, denture fit) • High-gain custom hearing aid • Earmold coupled with a high-gain hearing aid • Remake required (i.e. fit issues, feedback, etc.) 	<ul style="list-style-type: none"> • Less severe hearing loss • Canal shape not impacted by jaw movements

Earmold Impression Materials

There are three types of impression materials

1. Acrylic/Powder & Liquid

- Combine a powder and a liquid (i.e. methyl methacrylate)
- Sets quickly
- May distort during removal from ear
- Short shelf life
- 2-5 % shrinkage begins in about 1 week
- Climate and heat impacts stability: hot weather can cause distortion and melting
- Care required when shipping to manufacturer: glue down and pack properly

2. Condensation Cured/ C-Silicone:

- Example: Dimethyl-siloxane
- Combine a putty with an activator from a tube at a 10:1 ratio
- 0.5% shrinkage

3. Addition-cured/ A-silicone:

- Example: Polyvinylsiloxane
- Mix two putties at a 1:1 ratio
- Widely available in pre-measured packages, bulk containers, and cartridges for impression guns
- Low impression shrinkage about 0.1%
- Flexible/elasticity with removal
- Stable

Good to Know

- Colour of impression material does not indicate type or characteristics
- Example: a green silicone from one manufacture may have different characteristics (i.e. viscosity) than the same colour from another manufacture

Earmold Impression Material Characteristics

After-mix viscosity	The ease at which the material flows out of the syringe <ul style="list-style-type: none">▫ Higher viscosity=firm/dense▫ Low viscosity=soft
Dimensional stability/ Contraction ratio	Material shrinkage
Stress relaxation	The ability of the impression to regain its shape after being twisted and stretched during removal from the ear
Tensile Strength	The strength of the material to stay together and not tear during removal
Shore value/ After-cure hardness	The ease at which the impression is removed from the ear; not the same as viscosity and this value is not often used <ul style="list-style-type: none">▫ High value=firm▫ Low value=soft
Effectiveness of the release agent	Prevents material from adhering to the ear and produces an oily residue

The most important earmold impression material characteristic is the viscosity

Considerations for viscosity:	
Low viscosity <ul style="list-style-type: none">▫ Deep impressions▫ Less severe losses	High viscosity <ul style="list-style-type: none">▫ Severe hearing loss▫ Snug fit▫ Ear hair (will not get stuck in material)

Earmold Impression Complications

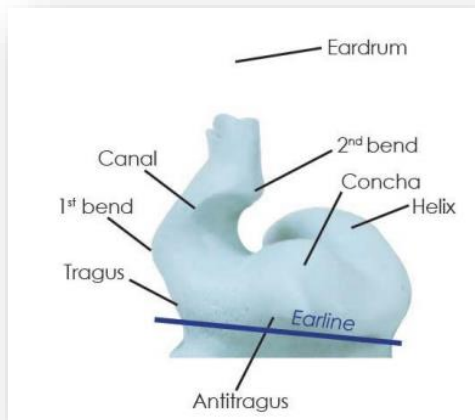
- Impression material in middle ear space
- Perforate tympanic membrane
- Disturb surgical areas/procedures such as PE tube, mastoidectomy
- Trauma to skin or tympanic membrane
- Irritate skin
- Impact cerumen
- Vasovagal response
- Aggravate certain conditions such as Meniere's disease

(College of Speech and Hearing Health Professionals [CSHBC], 2018)

Due to the potential risk of harm, obtaining informed consent and ensuring that you possess the competencies to perform this task is
vital

If a complication arises, it may be necessary to refer to
Otolaryngology or Family Physician

Parts of an Earmold Impression



CSHBC, 2018

Considerations for a Custom Mold for a RIC

- Secure fit/Prevent loss
- Customized fit to a non-custom hearing aid (i.e. RIC/RITE)
- Comfort
- Dexterity concerns
- Ease of use (i.e. cleaning and maintenance)
- Non-custom ends do not fit properly (i.e. domes)
- High gain
- Feedback
- Surgical ear
- Personalization (i.e. colour, name)
- Aesthetics (i.e. discreet)



Oticon, n.d.

EARMOLD IMPRESSIONS: PRACTICE

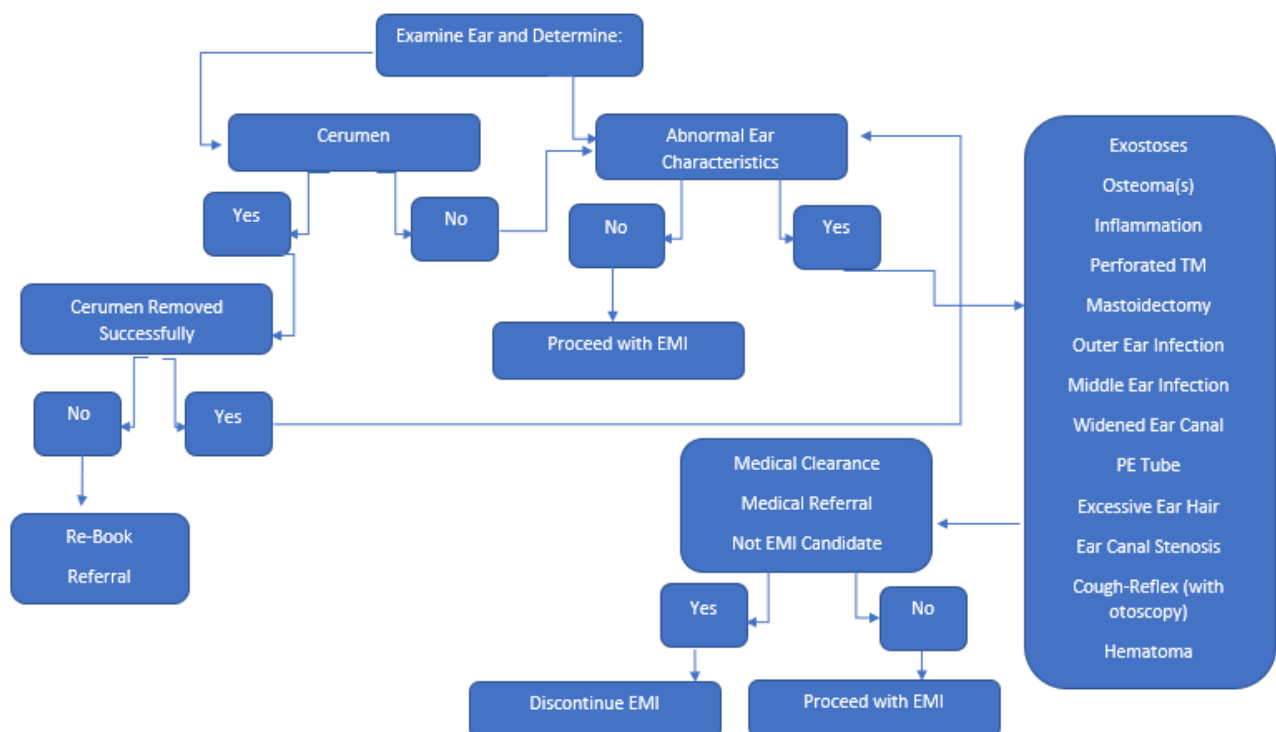
Before you begin: Positioning
Important that you and your patient are positioned/seated comfortably

STEP 1: Otoscopy

1. Obtain consent and provide instructions to CARL
2. Pull pinna up and back and use bracing techniques to examine the ear
3. Examine ear thoroughly (see flow chart on next slide)

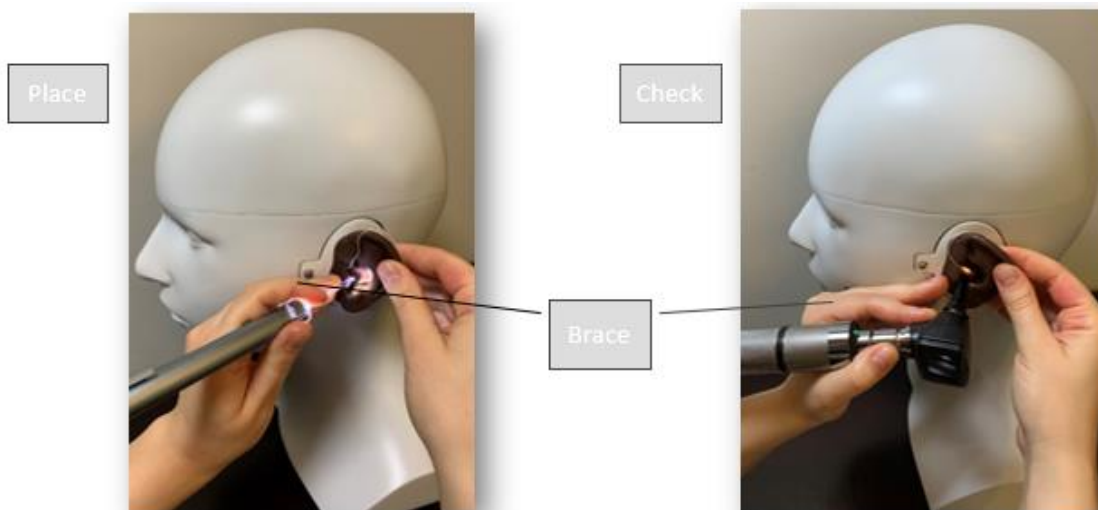


Example Ear Examination Flowchart



STEP 2: Otoblock Selection & Placement

- Otoblock prevents impression material from reaching the eardrum
 - Select size and type of otoblock
 - Too small: material will flow past
 - Too big: uncomfortable or limit depth of impression
 - Foam: takes up more space (less information about the ear) and is more abrasive
 - Cotton: modifiable and comfortable for deep impressions
 - Phonak Easy View Otoblock: allows for visualization of tympanic membrane during placement
1. Use otolight to carefully place otoblock in correct position, ideally past the second bend, about 5 mm (Dillion, 2012), especially for a deep-fitting hearing aid
 - **If using CARL earmold impression ears, then apply lubrication to cotton otoblock to prevent sticking**
 - **If using regular CARL ears (translucent or regular), use lubrication such as Vaseline and cover all surfaces that will come into contact with impression material**
 - When doing a deep impression (i.e. CIC or IIC), consider using a cotton block with a pressure-relief tube
 - Pay attention to the amount of ease it takes to position the otoblock; easier insertion may indicate a widening in the canal which could make it difficult to remove the impression
 2. Using otoscopy, check otoblock is positioned at proper depth and there are no spaces where impression material can flow through



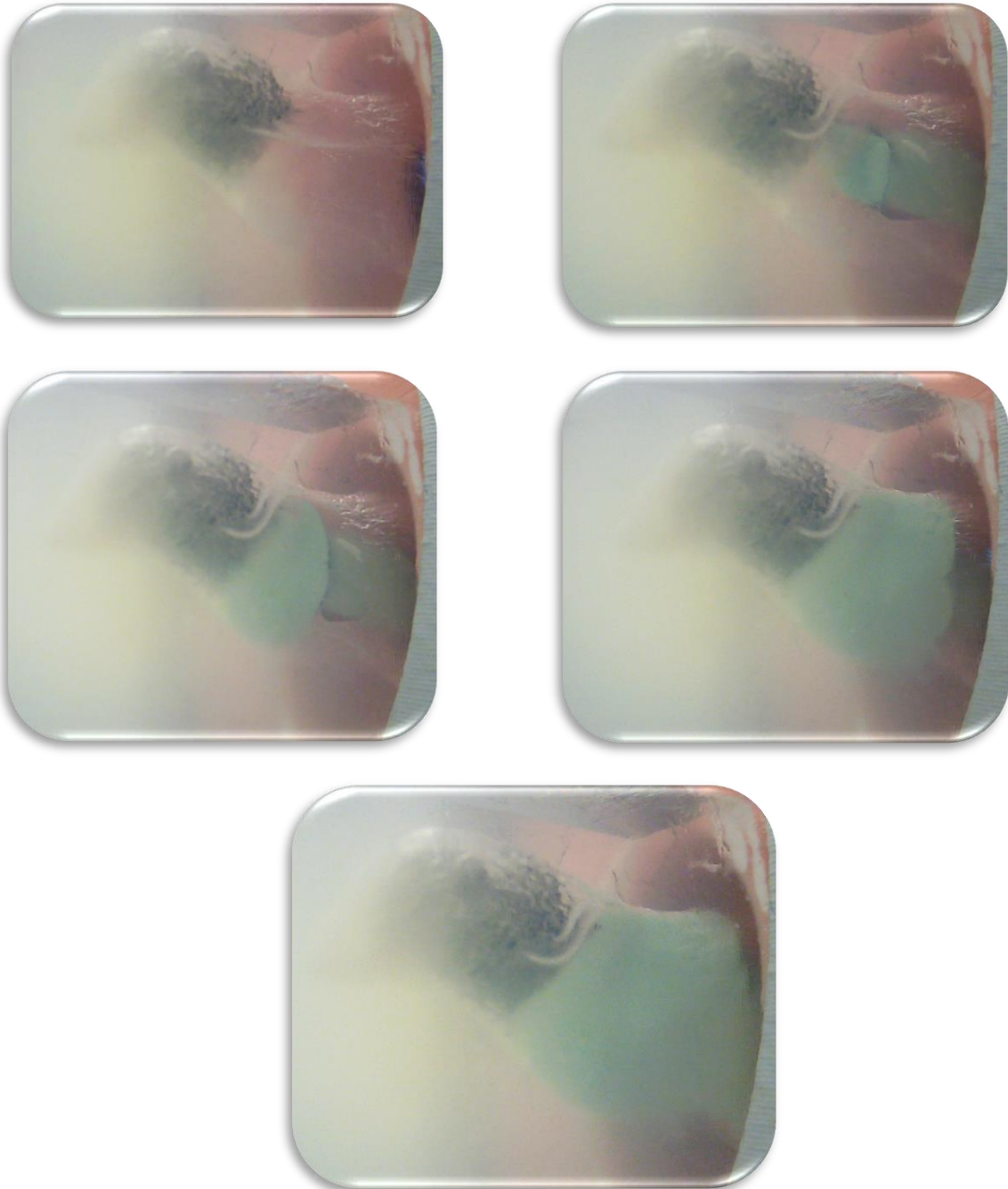
STEP 3: Impression Material Selection & Mixing

1. Be thorough; mix completely and quickly, according to manufacturers guidelines
 - You can use a spatula to avoid touching the material directly and adversely affecting it by raising its temperature and introducing substances that are on your skin
2. Place impression material into the syringe and ensure the plunger stopper is at the plunger tip
3. Push plunger until material has reached the end of the syringe (see picture on next page)



STEP 4: Taking an Impression

1. Using proper bracing techniques, insert tip of syringe into the ear canal without plugging the canal
2. Inject material into canal with constant pressure and small circular motions to fill the canal, concha, tragus and helix areas.
 - As the ear fills, the material will flow back onto tip, when there is about 6mm (Dillon, 2012), start to slowly remove syringe laterally while maintaining pressure and keeping the end of syringe surrounded in the material
 - Do not use excessive pressure



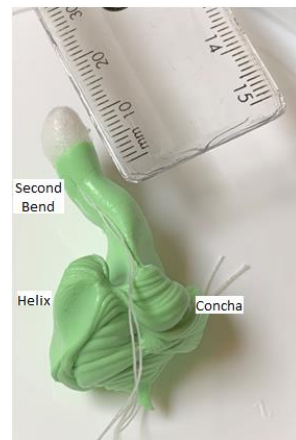
3. Allow material to harden, around 5-10 minutes (refer to manufacturers instructions)
 - If making an ITC or ITE while material is soft, you can use an edge to make a horizontal indent in the impression to assist manufactures with the placement of the directional microphone ports
4. Check if impression is completely hardened by using a fingernail; if no mark is made then it is ready to be removed

5. Gently move pinna in a circular motion while removing the impression first by releasing the helix and rotating the impression forward toward the patients nose
 - Tip: Instruct patient to open and close jaw to relieve pressure especially for deep impressions



STEP 5: Inspect Ear & Impression

1. After removing impression, check the ear with the otoscope
2. Examine impression:
 - Past second bend
 - Free from air pockets, creases, underfilled areas
 - Connected to otoblock
 - Includes all anatomical structures (i.e. helix)

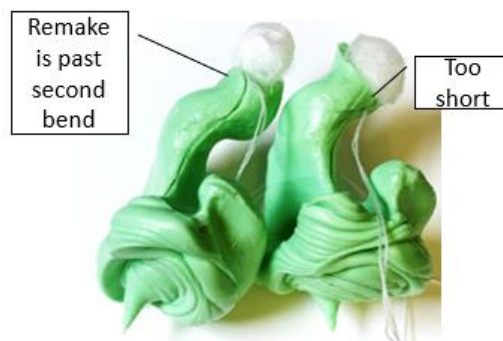
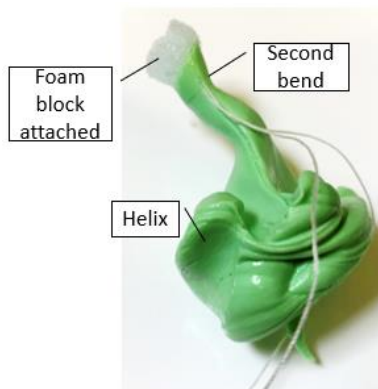


STEP 6: Document & Complete Order

- Complete chart notes based on session
- Complete manufacturer order form (optional)

NOTES:

EARMOLD IMPRESSION EXAMPLES




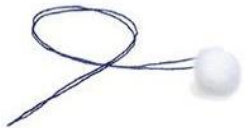










EVALUATING COMPETENCIES

At the end of this lesson, professionals and student clinicians should be able to:

- Examine the external auditory canal before and after taking earmold impressions
- Effectively use bracing techniques during otoscopy and earmold impression stages
- Know different impression materials and characteristics
- Utilize techniques to create earmold impressions
- Understand earmold impression process/stages
- Identify earmold impression equipment and materials
- Distinguish acceptable and remake earmold impressions

EXERCISES

NAME THE FOLLOWING EQUIPMENT	
	
	
	
	
	
	
	

DISCOVER

Write your observations in the space provided below.

Experiment using different types of otoblocks	
Create earmold impressions for small and large CARL ears	
Experiment using different earmold impression methods (i.e. impression gun)	
Experiment using different impression materials	
Trade impressions with a partner and identify acceptable and remake impressions	

CARL THE PATIENT: CASE STUDIES

On the following pages are example situations using CARL as your patient. Each case will contain the patients main concern, case history, and assessment results. Using the information provided, you will be able to demonstrate your clinical knowledge and earmold impression skills by completing a detailed patient report for each situation. For a blank template, see the additional resources section.

Case Studies: Extension

In the “Summary and Recommendations” section, if applicable, include what assessment or case history information was missing. Explain the significance this information would have had on session.

EXAMPLE 1



**AHead
Simulations**

Name: CARL

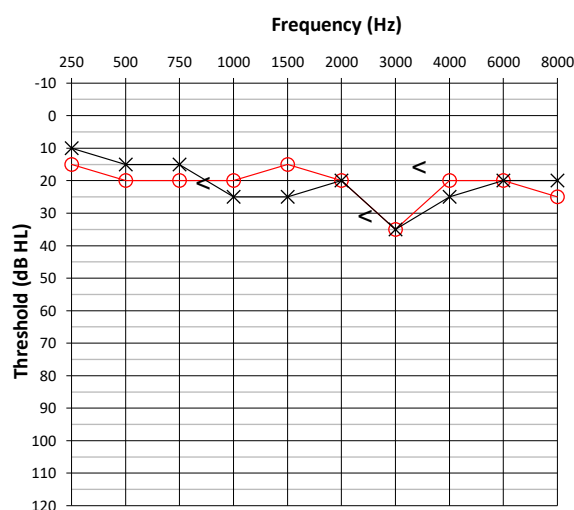
Date: _____

Main Concern: Tinnitus

History: Carl is 40 years old and plays the drums in a band on weekends for the past 20 years. He has noticed a ringing in both of his ears after practices and performances. Carl does not wear any hearing protection and has never had a hearing test. All other case history was unremarkable.

Assessment: Below are Carl's assessment results.

	Right	Left
Word Recognition Score	90%	100%
Speech Reception Threshold	20 dB HL	25 dB HL
Acoustic Admittance Measures		
Ear Canal Volume	1.8 cc	1.4 cc
Acoustic Admittance	.63	.74
Middle ear pressure	-10	-28



Treatment: Write below, your suggested treatment plan

AFTER DISCUSSING OPTIONS, CARL DECIDES TO PURCHASE CUSTOM HEARING PROTECTION. USING CARL, CREATE EARMOLD IMPRESSIONS

Summary and Recommendations: Write a summary of the appointment and include all recommendations. (Bonus: Include type of hearing protection you recommend)

EXAMPLE 2



**AHead
Simulations**

Name: Maria

Date: _____

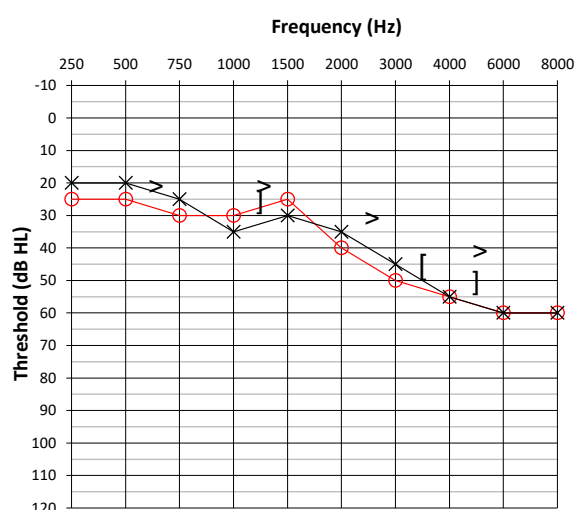
Main Concern: Difficulty hearing

History: Maria is 65 years old and often asks for repetition. Her husband was recently fit with binaural amplification and listens to the television at a softer volume than what she can hear. If she needs hearing aids, she wants something very discreet. Maria is a type 1 diabetic and takes insulin. All other case history was unremarkable.

Assessment: Below are Maria's assessment results.

	Right	Left
Word Recognition Score	80%	85%
Speech Reception Threshold	35 dB HL	35 dB HL
QuickSIN Score	8 dB SNR Loss	

Treatment: Write below, your suggested treatment plan.



AFTER DISCUSSING OPTIONS, MARIA DECIDES TO PURCHASE CUSTOM HEARING AIDS. USING CARL, CREATE EARMOLD IMPRESSIONS.

Summary and Recommendations: Write a summary of the appointment and include **all** recommendations. (Bonus: Include type of hearing aids you recommend and why)

EXAMPLE 3



**AHead
Simulations**

Name: Raul

Date: _____

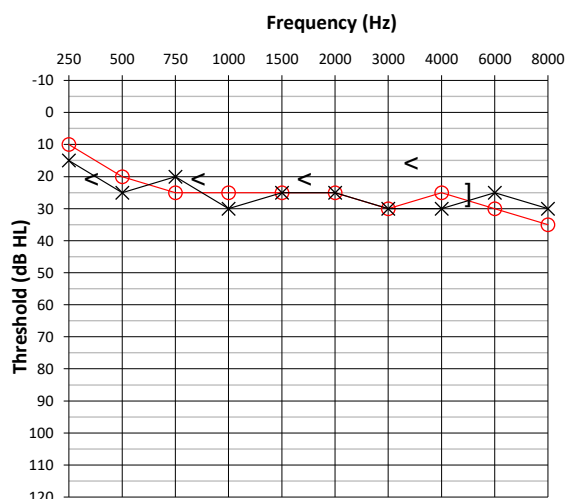
Main Concern: Earplugs for sleep

Case History: Raul is a shift worker at a factory. Raul regularly uses hearing protection at work and would like sleep plugs (for sleep). Raul wants to know if he can use sleep plugs for work. Raul takes medication for his thyroid.

Assessment: Below are Raul's assessment results.

	Right	Left
Word Recognition Score	100%	92%
Speech Reception Threshold	25 dB HL	30 dB HL
Otoscopy	Exostoses present bilaterally	

Treatment: Write below, a script of your suggested treatment plan and a description of the procedure



AFTER DISCUSSING OPTIONS, RAUL DECIDES TO PURCHASE CUSTOM SLEEP PLUGS. USING CARL, CREATE EARMOLD IMPRESSIONS.

Summary and Recommendations: Write a summary of the appointment and include **all** recommendations. (Bonus: Would you recommend hearing aids?)

EXAMPLE 4



Name: Lara

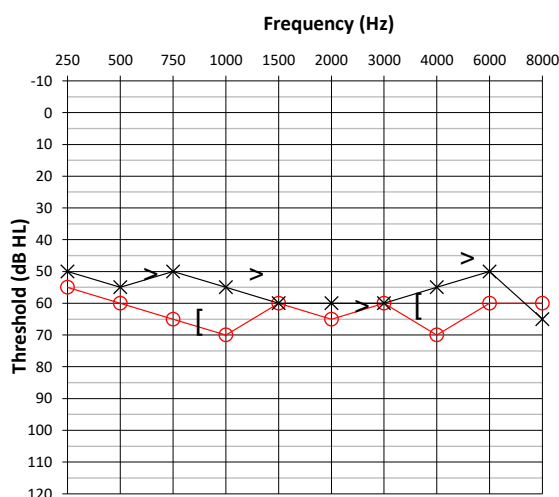
Date: _____

Main Concern: Difficulty hearing

History: Lara is 35 years old and has been wearing hearing aids since birth. Lara currently wears a set of 5-year-old behind-the-ear (BTE) hearing devices. Lara reports difficulty hearing in background noise and an increase in feedback. Lara is very active in sports and social activities. Lara reported multiple middle ear infections during childhood.

Assessment: Below are Lara's test results.

	Right	Left
Word Recognition Score	76%	72%
Speech Reception Threshold	65 dB HL	55 dB HL
Acoustic Admittance Measures		
Ear Canal Volume	.8	.76
Acoustic Admittance	.4	.35
Middle ear pressure	-10	-56
Otосcopy	TM scarring	TM scarring

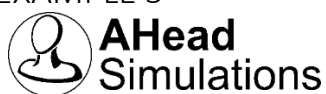


Treatment: Write below, a script of your suggested treatment plan and a description of the procedure.

AFTER DISCUSSING OPTIONS, LARA DECIDES TO PURCHASE NEW HEARING AIDS WITH MOLDS. USING CARL, CREATE EARMOLD IMPRESSIONS.

Summary and Recommendations: Write a summary of the appointment and include all recommendations. (Bonus: Include specifics about recommended hearing aids and molds (i.e. style, gain, venting, etc.))

EXAMPLE 5



Name: Ahmed

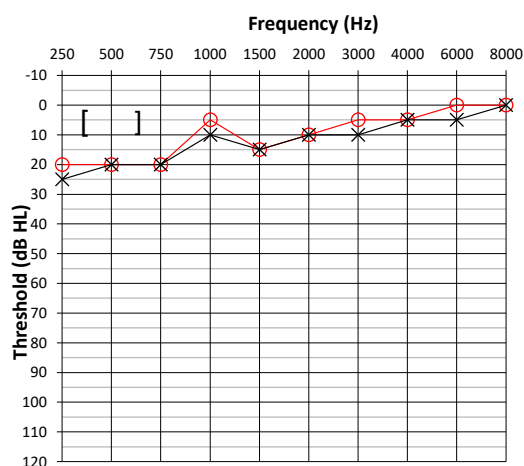
Date: _____

Main Concern: Swim plugs

History: Ahmed is 15 years old and has bilateral pressure equalization (PE) tubes due to recurring middle ear infections. Ahmed is a competitive swimmer and his otolaryngologist recommended swim plugs.

Assessment: Below are Ahmed's assessment results.

	Right	Left
Word Recognition Score	100%	100%
Speech Reception Threshold	10 dB HL	15 dB HL
Acoustic Admittance Measures		
Ear Canal Volume	2.1	2.5
Acoustic Admittance	--	--
Middle ear pressure	--	--
Otoscopy	PE tube	PE tube



Treatment: Write below, a script of your suggested treatment plan and a description of the procedure.

AFTER DISCUSSING OPTIONS, AHMED DECIDES TO PURCHASE SWIM PLUGS. USING CARL, CREATE EARMOLD IMPRESSIONS.

Summary and Recommendations: Write a summary of the appointment and include **all** recommendations.
(Bonus: Are the PE tubes 'working'?)

Reflection

- After completing this lesson, reflect below on your experience creating earmold impressions with CARL
- What skills have you improved (i.e. patient scripts, bracing techniques, etc.)?
- What other areas are you looking forward to improving next using CARL as the patient?

ADDITIONAL RESOURCES



AHead
Simulations

Name: _____

Date: _____

Main Concern:

Case History:

Assessment:.

Treatment:

Summary and Recommendations:

CARL Patient Chart

Use this CARL patient chart to document CARL sessions and record insights, new skills, or difficulties experienced.

Name: _____

Date: _____

Topic: _____

Skill(s): _____

Notes: _____

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

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