CARL
CERUMEN MANGEMENT
WORKBOOK

AHead Simulations

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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 validation 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 cerumen management information.

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

Enjoy your CARL experience!

Ahead Team

CERUMEN MANAGEMENT

SIMULATED CERUMEN MANAGEMENT WITH CARL

Lesson Overview:

Simulated cerumen management 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 trainees have which can **strengthen** their skills and **improve** the possibility of successful cerumen management
- 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 otoscopy, irrigation, and manual techniques
- Improve critical thinking skills to determine best outcomes using a specific technique with minimal risk of harm
- Practice proper force and bracing techniques involved with otoscopy and cerumen removal
- Remove a cerumen-like substance using manual techniques and irrigation
- Create comprehensive chart-notes based on session

Lesson Prep:

REVIEW

Infection control guidelines, ear anatomy including cranial nerves, epidemiology, cerumen management tools and devices, obtaining a thorough case history including modifying factors and symptoms of cerumen impaction, potential risks of harm, emergency protocols, government regulations, and regulatory college practice standards and regulations including professional liability insurance

Materials and Equipment:

- CARL
- Different CARL ears
- CARL Patient Chart
- Illumination using different light sources
  - Otoscope
  - Electric headlight
  - Video otoscope
  - Operating microscope
- Aural specula
  - Plastic
  - Metal
- Aural forceps
- Curettes
  - Stainless steel
  - Plastic
- Irrigation equipment with emesis basin
  - Electric
  - Manual
- Suction Machine
- Suction Tips
- Simulated earwax
  - Pre-made
  - Home-made

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

Lesson Extensions

- Over-the-counter (OTC) cerumen management
    - Example: cotton swabs, Earigate, ear bulb syringe
- Foreign bodies in the external ear canal (i.e. hearing aid dome, hearing aid battery, cotton swab tip)
- Using Verifit, measure effects of cerumen on ear canal acoustics
- Earmold impressions
- Proper fit, insertion, and removal of hearing aids, earmolds (i.e. hearing aid, noise, swim, musician, and sleep)

Introduction to Cerumen Management:

- Cerumen is a naturally occurring substance produced in the cartilaginous portion of the external auditory meatus
- Excessive or occluding earwax is found in:
    - 13% of Canadian adults (Feder et al., 2015)
    - 11% of 20-39 year olds and 21% among 70-79 year olds (Feder et al., 2015)
    - 17% of Canadian children and adolescents (Feder et al., 2016)
- Symptoms of cerumen impaction include tinnitus, aural fullness, otalgia, cough, and hearing loss (Schwartz et al., 2017)
- Cerumen management is the act of removing cerumen or ear wax from the external auditory canal
- Presence of cerumen can impact various tests including otoscopy, immittance, audiometry, electocochleography, auditory brainstem response, caloric testing, and real-ear measures (Schwartz et al., 2017)
- Cerumen can also impact earmold impressions, earmold fittings, and hearing aid fittings
- There are several techniques that can be used to remove cerumen
- Discussed in the proceeding slides are manual techniques including curette and suction, and irrigation

What Can Be Used to Simulate Cerumen?

- Play Dough
  - Very soft
  - Possible uses: Irrigation
  - Pro: can make at home
- Sticky Tack
  - Soft and pliable
  - More structure than playdough
  - Possible uses: curette and irrigation
  - Pro: often found in clinics and works **best** for curette
- Banana
  - Very soft
  - Possible uses: Suction and irrigation
  - Pro: inexpensive
- Slime
  - Semi-liquid
  - Possible uses: Suction and irrigation
  - Pro: can make at home
- GT Simulations Ear Wax
  - Costly
  - Shipping time
  - Pro: Premade
- Heartzap Simulated Ear Wax
  - Costly
  - Shipping time
  - Pro: Premade
- Experiment with other materials

Home-Made "Cerumen" Recipe

Two-Ingredient Playdough	
Ingredients • Cornstarch • Baby lotion or hair conditioner or dish soap • Optional: food colouring	Directions 1. In a bowl, mix first two ingredients. 2. Experiment with portions; more cornstarch will make it more crumbly. Optional: Add few drops of food colouring so it shows up better on the camera Optional: Add small beads or other elements to give texture

Softened Sticky Tack	
Ingredients • Sticky Tack • Lotion or hand soap	Directions 1. Add a small amount of lotion or hand soap to the sticky tack and combine 2. Add more lotion to make the sticky tack softer and stretchy Optional: Add small beads or other elements to give texture

Notes:

STEP 1: Otoscopy

- Provide instructions to CARL
- Inject simulated earwax into ear canal or inject onto surface and deposit/insert into canal
- Using otoscopy techniques previously practiced, assess the amount, location, and consistency of the simulated earwax and determine the best technique for removal

STEP 2: Determine the best treatment option which may be a combination of the following: observation, cerumenolytics, manual removal, irrigation, or medical referral.

- Consider the risks; all techniques can pose a risk when not used properly

STEP 3: Ensure you and the patient are positioned/seated comfortably

STEP 4: Continually assess

OPTION 1| Manual Removal: Curette, Forceps, Hook

Advantages	Potential Risks/Drawbacks

• Low-tech
• Inexpensive
• Effective
• Convenient
• Portable
• Low space requirement
• Acceptable for the use in patients that have certain modifying factors that preclude the administration of other techniques
  ▫ May reduce risk of infection by not exposing the ear to moisture (McCarter et al., 2007)
	• Tympanic membrane perforation
	  ▫ Hearing loss
	• Otalgia
	• Injury to ear canal
	  ▫ Laceration
	  ▫ Bleeding
	  ▫ Pain/Discomfort

PROCEDURE:

- Provide instructions to CARL
- Select light source and appropriate curette, forceps, and/or hook based on consistency and degree of cerumen impaction:
    - Curettes: Buck, Shapleigh, Billeau, Lucae
    - Forceps: Alligator
    - Hooks: Day, Lucae
- According to Bankaitis (2013), the larger the occlusion, the smaller the surface area of the instrument's tip
- If the wax is not occluding and there is an open space, place the tip of curette in the opening and gently remove debris laterally
- If the wax is occluding, try to create an opening by breaking off pieces of wax using a hook (i.e. Day hook)
- During cerumen removal, you may need to switch to a different size or type of curette, or a different technique
- No leveraging (Bankaitis, 2013). It is important to avoid too much pressure/force and dragging the instrument along the canal wall as this would be uncomfortable/painful to a real patient

Tip: a metal speculum can be used to focus light into the canal (Purdy, 2002) and to improve accuracy (Wilson, 1997)

Hartmann speculum

Sticky tac with metal speculum and Bionix microloop curette (painted black for demonstration)

Hartmann speculum with Bionix lighted curette

NOTES:

OPTION 2| Manual Removal: Aural Suction

Advantages	Potential Risks/Drawbacks

• Effective
• Portable option available
• Acceptable for the use in patients that have certain modifying factors that preclude the administration of other techniques
  ▫ May reduce risk of infection by not exposing the ear to moisture (McCarter et al., 2007)
	• Expensive
	• Maintenance
	• Bulky
	• Injury to ear canal
	  ▫ Laceration
	  ▫ Bleeding
	• Perforated tympanic membrane
	• Nystagmus and vertigo (Schwartz et al., 2017)
	• Loud noise
	• Sound may startle patient
	• Pain/Discomfort

PROCEDURE:

- Best for very soft or semiliquid cerumen (Wilson, 1997)
- Provide instructions to CARL
- Optional: Use the largest aural speculum possible for comfortable placement in the ear canal
- Select light source and appropriate suction tips
- Have warm water nearby to unclog instrument

Tip: a metal speculum can be used to focus light into the canal (Purdy, 2002) and to improve accuracy (Wilson, 1997)

NOTES:

OPTION 3| IRRIGATION

Advantages

- Various options
  - Manual or electric versions
- Various cost options
- Effective
- Convenient
- Portable
- Minimal space requirement

Potential Risks/Drawbacks

- Limitations in patients that have certain modifying factors
- Tympanic membrane perforation
- Patient discomfort with water in ears
- Hearing loss
- Otalgia
- Temporal bone osteomyelitis
- Injury to ear canal
  - Laceration
  - Bleeding
  - Pain
- Tinnitus
- Otitis externa
- Otitis media
- Vertigo

PROCEDURE:

- Before you begin, run water in CARL's ear to ensure there are no punctures from other exercises
- Provide instructions for CARL
- Place towel under basin
- Basin should be placed directly under ear and against head
- Place tip of irrigation tool in the ear and gently irrigate using **warm** water to prevent caloric-reflex
- Do not insert too far so that the water will be able to drain out and to avoid pressure from building up
- Do not direct stream at the eardrum
- Check progress every 20-30 seconds using otoscopy (Wilson, 1997), continue to assess whether an alternative technique is required

Bionix Otoclear Spray Wash with basin

NOTES:

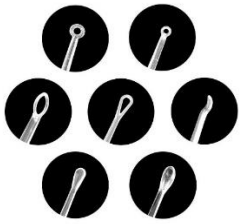
EVALUATING COMPETENCIES

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

- Examine the external auditory canal before, during, and after intervention
- Effectively use bracing techniques during otoscopy and cerumen removal
- Know the different types of cerumen management techniques
- Distinguish between the different types of equipment
- Use critical thinking to determine best/safest technique
- Understand how to operate different equipment

EXERCISES

NAME THE FOLLOWING EQUIPMENT	
	
	
	
	
	
	

Discover

For tables see additional resources section.

- Experiment with different light sources when using manual techniques and reflect on cost, ease of use, brightness, magnification, and clarity.

- Evaluate and rank different aural irrigators, consider: Ease of use, cost, patient comfort, potential risk of harm.

- Try the various types of curettes, forceps, and hooks available including the different materials they are made of. Reflect on whether certain instruments were preferable.

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 cerumen management 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:

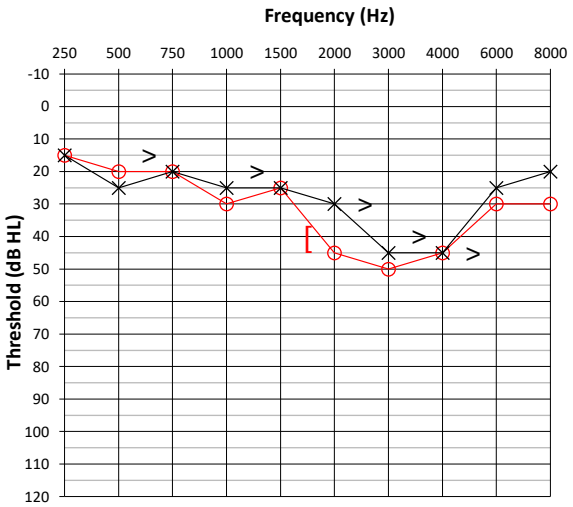
Main Concern: Itchy and plugged feeling in both ears.

History: Carl is a 58 year old factory worker. Carl has worked in noise for over 30 years and does not always wear hearing protection. CARL has constant bilateral "hissing" tinnitus for approximately 5 years. Carl has the TV volume turned up more than his wife prefers and has difficulties hearing at family get togethers. Carl denied a history of the following: ear infection, ear surgery, medical condition, and prescription medication.

FIRST, YOU WILL NEED TO DEPOSIT SIMULATED CERUMEN IN EACH EAR

Assessment: *Below are Carl's results after cerumen removal. Describe or illustrate otoscopy findings below.*

	Right	Left
Word Recognition Score	76%	82%
Speech Reception Threshold	30 dB HL	30 dB HL
Acoustic Admittance Measures		
Ear Canal Volume	1.5 cc	1.8 cc
Acoustic Admittance	.52	.8
Middle ear pressure	-63	-12
Otoscopy		
Right	**Left**	



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

Summary and Recommendations: *Write a summary of the appointment and include all recommendations based on the results.*

EXAMPLE 2

AHead Simulations

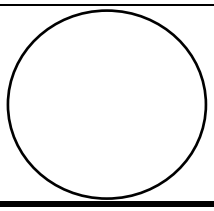
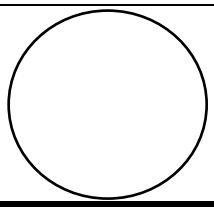
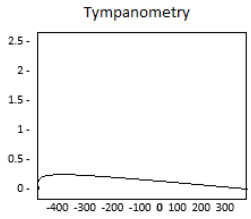
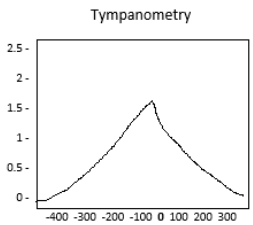
Name: CAROL Date: _____

Main Concern: Failed online hearing screening in **one** ear.

History: Carol is 47 years old and failed an online hearing screening in the left ear. Carol reported a few middle ear infections as a child but did not require any surgery or additional care. Carol's father got his first set of hearing aids this year. Carol is on a blood thinner, cholesterol, and blood pressure medications. All other case history was unremarkable.

FIRST, YOU WILL NEED TO DEPOSIT SIMULATED CERUMEN IN EACH EAR

Assessment: *Below are Carol's results before and after cerumen removal. Describe and illustrate otoscopy findings below.*

Otoscopy		
	Right	**Left**
Description		
Illustration		
Tympanogram (Left Ear Only)		
Before		
After		

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

Summary and Recommendations: *Write a summary of the appointment and include all recommendations based on the results.*

EXAMPLE 3

AHead Simulations

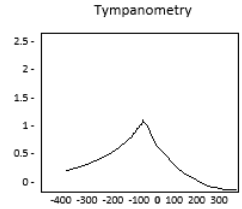
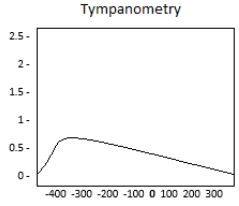
Name: TIMOTHY Date: _____

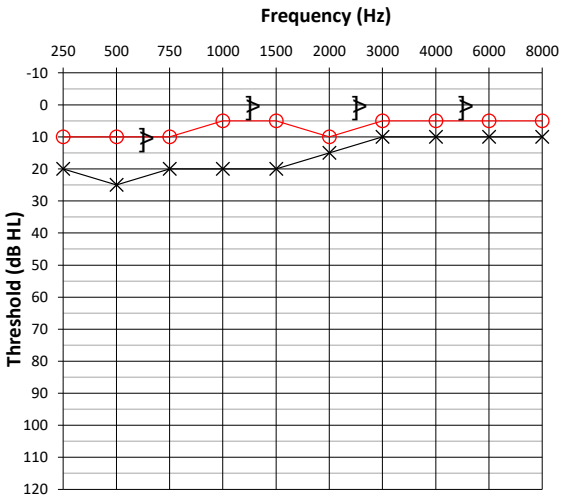
Main Concern: Aural fullness and discomfort.

Case History: Timothy is 7 years old and has been complaining about his left ear. Timothy was born full-term without complications and passed his newborn hearing screening. Timothy has had approximately 5 middle ear infections (MEI's) since birth; usually in the left ear. In the past 12 months, Timothy has had 2 MEI's that were treated with antibiotics, prescribed by his family physician. Parents have no hearing concerns. Timothy is doing well in school, but his parents have concerns about his pronunciation of /th/, /s/, and /r/. All other case history was unremarkable.

USE SMALL CARL EARS AND DEPOSIT SIMULATED CERUMEN IN EACH EAR

Assessment: *Below are Timothy's results after cerumen removal. Describe otoscopy findings below.*

Tympanogram	
Right	**Left**
	
Otoscopy	
Right	**Left**



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

Summary and Recommendations: *After treatment, the tympanogram did **not** change and you completed a hearing assessment (results above). *Write a summary of the appointment and include all recommendations based on the results.*

EXAMPLE 4

AHead Simulations

Name: STEPHANIE Date: _____

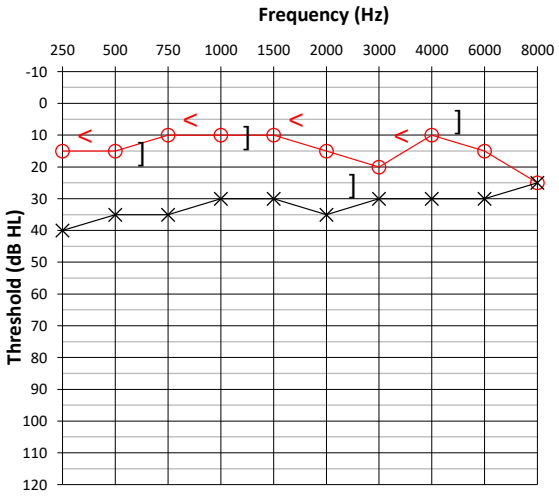
Main Concern: Difficulty hearing and constant ringing in left ear.

History: Stephanie is 31 years old and is expecting her second child. She has noticed a gradual decline in hearing in her left ear over the years. Her mother has had hearing issues for many years since her 20s-30s but has not sought treatment. She worked in a factory for a few summers while in university and often wore hearing protection. She denied having any other medical issues, prescription medications, dizziness, ear infections, or ear surgery.

FIRST, YOU WILL NEED TO DEPOSIT SIMULATED CERUMEN IN BOTH EARS

Assessment: *Below are Stephanie's results after cerumen removal. Describe otoscopy findings below.*

	Right	Left
Word Recognition Score	100%	100%
Speech Reception Threshold	15 dB HL	30 dB HL
Acoustic Admittance Measures		
Ear Canal Volume	1.0 cc	.8 cc
Acoustic Admittance	.6	.75
Middle ear pressure	-52	-25
Otoscopy		
Right	**Left**	



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

Summary and Recommendations: *Write a summary of the appointment and include all recommendations based on the results.*

EXAMPLE 5

AHead Simulations

Name: PATRICK Date:

Main Concern: Hearing loss, aural fullness, tinnitus all in one ear.

History: Patrick is 43 years old and 3 days ago when he woke-up, he noticed a significant change in hearing in his right ear. He thought it was earwax and put oil in his ear hoping it would get better, but it has not. He saw his family physician who noted wax in both ears and recommended seeing an audiologist for cerumen removal. Patrick is a type-2 diabetic, and his condition is managed well. Patrick takes oral medications for his diabetes and high cholesterol. All other case history was unremarkable.

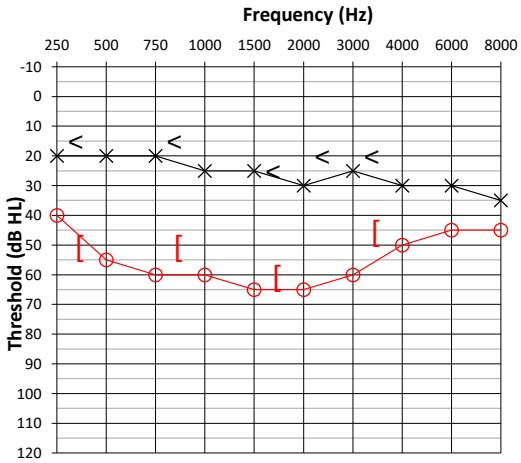
FIRST, YOU WILL NEED TO DEPOSIT SIMULATED CERUMEN IN BOTH EARS

Assessment: *Below are Patrick's results before and after cerumen removal. Describe otoscopy findings below.*

Acoustic Admittance Measures BEFORE		
	Right	**Left**
Ear Canal Volume	.3 cc	1.5 cc
Acoustic Admittance	-----	.9
Middle ear pressure	-----	-63

Acoustic Admittance Measures AFTER		
	Right	**Left**
Ear Canal Volume	1.2 cc	1.5 cc
Acoustic Admittance	.85	.9
Middle ear pressure	-34	-63

Otoscopy	
Right	**Left**



	Right	**Left**
Word Recognition Score	46%	90%
Speech Reception Threshold	60 dB HL	25 dB HL

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

Summary and Recommendations: *Write a summary of the appointment and include all recommendations based on the results.*

Reflection

- After completing this lesson, reflect below on your experience with simulated cerumen management 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 RESOUCES

Device Name	Cost	Easy to Use	Brightness	Magnification	Clarity	Rank

Device Name	Cost	Easy to Use	Comfort	Risk	Rank

Name	Type (Plastic, Metal)	Uses	Rank

AHead Simulations

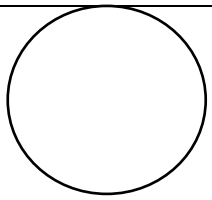
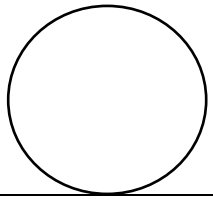
Name: _____ Date:_____

Main Concern:

Case History:

Assessment:.

Otoscopy

	Right	**Left**
Description		
Illustration		

Treatment:

Summary and Recommendations:

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