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continued

## Grand Rounds – Hearing Aids, Presented in partnership with the University of Pittsburgh

Catherine Palmer, PhD  
Virginia Milne, AuD  
Benjamin Boss, AuD  
Lori Zitelli, AuD  
Corrine Pfaff, AuD  
Megan Keirans, AuD



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continued

## Learning Objectives

- Discuss amplification options and considerations for clients with a variety of audiological and medical diagnoses (severe mixed hearing loss, Treacher Collins syndrome, CI candidates, auditory processing disorder, Menieres disease, etc.)
- Explain the benefits of bimodal hearing and wireless assistance technology for clients who are CI candidates.
- Describe non-amplification treatment options and considerations for clients with a variety of audiological and medical diagnoses.

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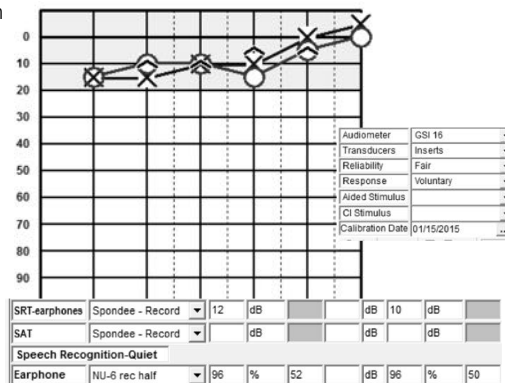
## Using Hearing Aids with a Patient with APD

AudiologyOnline Grand Rounds - Hearing Aids  
Virginia Milne, AuD

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## Meet Ms. W

- 21 y/o female; initially seen in otology clinic for difficulty understanding speech and balance issues
- PMH: fibromyalgia, anxiety
  - 1 ear surgery on the right and 2 on the left. Reasons/procedures are unclear
- Otoscopy:
  - Right: EAC clear and TM visible and WNL
  - Left: EAC clear and TM visible and WNL
- Audiogram today
- Dx: unknown
- Plan: APD evaluation and vestibular evaluation
  - Vestibular evaluation completed a couple weeks later and all results were WNL. Physician recommended that gait instability was related to hip pain



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## 2 years later

- Ms. W contacts clinic about APD evaluation
  - Get referral from previous physician and schedule for new Audio and APD evaluation in same appointment
- Audiogram consistent with previous results



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## APD Testing

- Primary concerns: difficulty in background noise especially socially (classes no longer a concern as she recently graduated)
- Case History: head trauma at age 5, difficulty in noise as long as she can remember, no prior testing, no OM Hx, highly motivated to seek solutions
  - Possibly entering Peace Corps soon. Recently applied to go to Mongolia


<https://www.peacecorps.gov/>

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## APD Test Battery Goals

- Testing the whole auditory pathway
- Removing this from being a “special clinic”
- Efficient
- Evidence Based for Protocol and Treatment
- Assess areas where individuals are struggling, even if a diagnosis is not possible due to confounding factors, to provide strategies and treatment to assist as deemed appropriate

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## APD Self Assessments

- Hearing Handicap Inventory (HHIE/A-S)
  - Utilized to assess degree that perceived hearing difficulty is impacting the patient
  - Score out of 40 for shortened version
- Adult Auditory Processing Checklist (AAPC)
  - Utilized to assess how each possible domain is impacting patients
  - Each domain is calculated as a percent of perceived difficulty in that area

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## Ms. W's Self Assessment Results

- HHIA-S: 32/40
  - Significant hearing handicap
- AAPC:
  - Decoding/SPIN: 60%
  - Integration/Dichotic: 37%
  - Temporal/Prosody: 35%

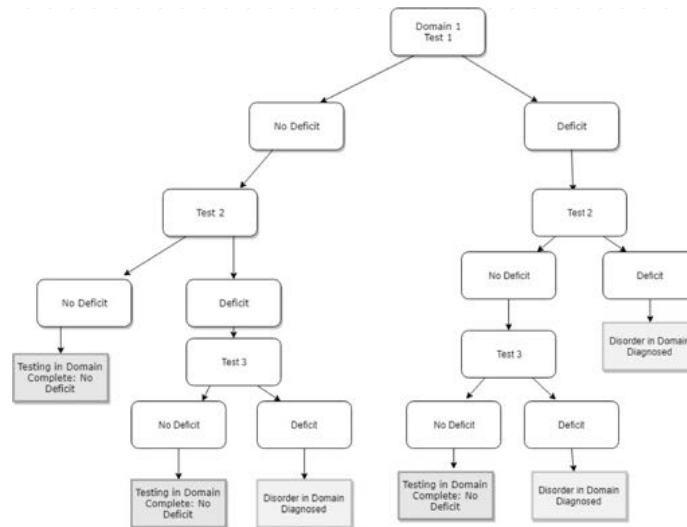
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## Domain Specific Testing

Domain	Tests Utilized
Dichotic	Randomized Dichotic Digits (RDDT)
	Dichotic Words (DW)
	Staggered Spondaic Words (SSW)
Speech In Noise	QuickSIN
	Words In Noise (WIN)
	Auditory Figure Ground (AFG)
Temporal	Frequency Pattern Labeling (FP)
	Frequency Pattern Hum (FP-H)
	Gaps In Noise (GIN)

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## Adult Flowchart Example



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## Ms. W's Test results

### Dichotic:

- RDDT: abnormal bilaterally, no significant ear advantage
- DW: abnormal bilaterally, no significant ear advantage

### Speech In Noise:

- WIN: Abnormal
- QuickSIN: moderate SNR loss

### Temporal:

- FP: WNL
- GIN: WNL

### Diagnosis

Decoding type APD

Report sent via email and TX discussion apt scheduled

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## Treatment Discussion

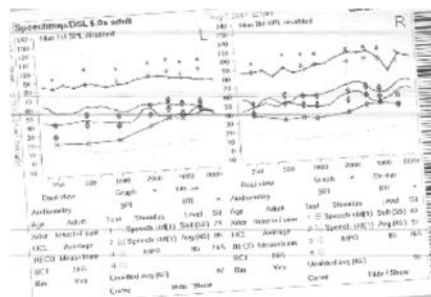
- Options discussed:
  - Remote microphone
  - Auditory Training Apps (free and pay)
  - Live Captioning Apps (free)
  - Communication Strategies
  - Delaying Treatment
  - Amplification

### Decision

Bilateral iPhone compatible BTEs

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## Delivery



- Hearing aids programmed to mild high frequency hearing loss and RECD/REAR completed
- Patient did well with batteries, insertion, iPhone pairing/operation, cleaning, etc.
- Follow-up scheduled for 2 weeks

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## Follow-up #1

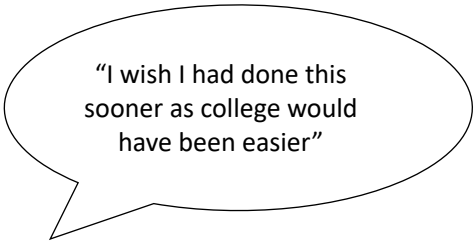
- Patient reports HAs too loud with loud noise
  - Decreased MPO
- Also HF sounds like running water and paper are bothersome
  - Decreased HF gain slightly
- On the fence about hearing aids
  - Find them helpful
  - Feels too young to have hearing aids

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continued

## Follow-up #2

- Patient feels more confident with hearing aids
- Doing better in social situations



"I wish I had done this  
sooner as college would  
have been easier"

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continued

## Decision Time

- Ms. W decides to keep the hearing aids.
  - Can't imagine making things more difficult without them
  - She is looking into ways to make the hearing aids work if accepted to the Peace Corps

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continued

## 2 Weeks later...

- Ms. W makes a phone call to the clinic
- She was accepted to the Peace Corps and is leaving for Mongolia shortly
- Also she has decided to return the hearing aids
  - She believed she would not be in noisy situations much during her stint in the Peace Corps
  - Also unsure of conditions and if she can make them a viable option where she will be and concerned about her whole warranty period being while she is away and unable to access our services
  - Indicated that she wants to pursue again upon her return in 2 years especially as she will likely enter graduate school at that time

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continued

### Take aways:

- Sometimes everything is right and life gets in the way
- Despite the patient returning the aids, this endeavor was not a waste of time!

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### Wrap Up

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## Bimodal Fitting with iPhone Compatible Devices

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Benjamin Boss, Au.D.

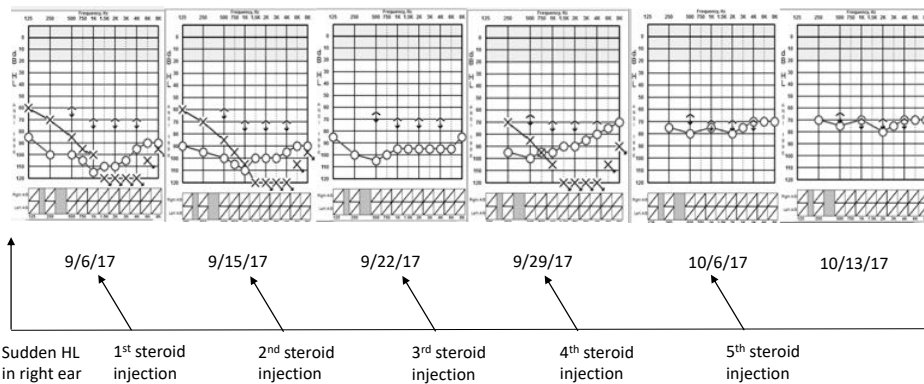
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## History of Present Illness

- 9/6/17
  - Patient is a 45 year old female
    - Self-referred right sudden hearing loss
  - Seen in ED on 9/4/17 and was prescribed prednisone taper 60mg
  - History of sudden hearing loss in the left ear from June 2008
    - Seen by ENT and received 5 intratympanic steroid injections with limited benefit
  - MRI completed in 2008 and again in 2017
    - Both negative for retrocochlear pathology
  - Right ear treated with 5 intratympanic steroid injections
    - Slight improvement in pure tone thresholds but speech understanding scores remained at 0%

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## Audiograms from (9/6/17-10/13/17)



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## What Next?

- Patient decided to forgo further steroid therapy
- Elected to move forward with audiology appointment for cochlear implant pre-testing and hearing aid discussion
- Underwent CT scan of temporal bone
- Return to otology to discuss results of cochlear implant pre-testing

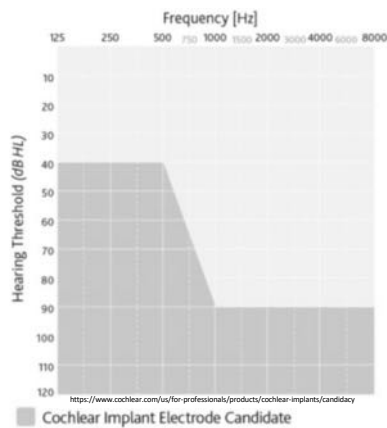
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## Cochlear Implant Pre-testing (10/20/17)

Test	Left ear score	Right ear score
HINT in quiet	0%	27%
AzBio Sentences in quiet	0%	18%
CNC Words in quiet	0%	22%
CNC Phonemes in quiet	0%	39%
AzBio Sentences in +5 SNR	0%	0%

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## Cochlear Implant Candidacy Criteria



- Adults
- Individuals 18 years of age or older
- Moderate to profound sensorineural hearing loss in both ears
- Limited benefit from amplification defined by preoperative test scores of  $\leq 50\%$  sentence recognition in the ear to be implanted and  $\leq 60\%$  in the opposite ear or binaurally

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## Hearing Aid and Cochlear Implant Discussion

- Discussed styles, technology, prices, and the benefits of bimodal hearing
  - Decided to pursue GNResound Linx 3D 5 BTE hearing aid for right ear
- Discussed all three cochlear implant manufacturers
  - UPMC is a two processor CI center
  - Cochlear Americas: one N7 (CP 1000) processor & one Kanso processor
  - Cochlear Multi Mic, Phone Clip +, Extra rechargeable battery, & accessory certificate were chosen as the 4 CI accessories



<https://www.cochlear.com/us/for-professionals/products/cochlear-implants/products>

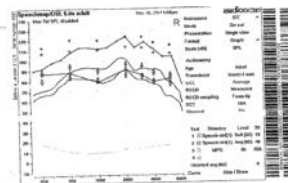


<https://www.cochlear.com/us/recipients/kanso>

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## Hearing Aid Fitting

- RECD and REAR measures were completed and met DSL adult 5.0 targets
- Patient enjoyed target gain and no further adjustments needed
- Counseled on realistic expectations
- Paired Resound Linx 3D BTE aid to patient's iPhone
  - Demonstrated use of "triple click" native iPhone feature for HA
- Downloaded Resound Smart 3D App
  - Instructed on use of app and available features
- Practiced phone call streaming through iPhone, native iPhone remote microphone feature "live listen", and streaming music



<https://www.resoundpro.com/en-Gb/compatibility>



<https://www.resound.com/en/hearing-aids/apps/smart-3d>

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continued

### 1 Month Hearing Aid Follow-up (12/7/17)

- Patient reports that she is noticing significant benefit from the hearing aid alone but does not have good speech clarity
- Patient is excited to have her CI activated

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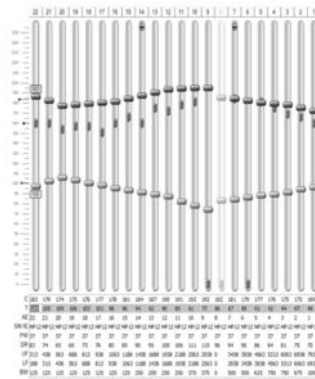
### Cochlear Implant Surgery

- Cochlear implantation surgery for the left ear was completed on 11/20/17
  - Neural Response Telemetry (NRT) measures in the operating room revealed all electrodes to be functioning
  - Impedance measures in the operating room were normal
  - No surgical complications

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## Initial Activation of Cochlear Implant (12/22/17)

- Accompanied to appointment by her mother and husband
- T and C levels were measured across all 22 electrodes
- Electrodes were balanced and swept
- NRT measures were completed across all 22 electrodes
- Impedance measures were normal across all electrodes except electrode 8 (high)
  - Turned off electrode 8
- Once implant was live patient reported hearing speech
  - Stated that everyone sounded like they were speaking through a synthesizer
  - Concerned that her own voice sounded strange



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## Linking the Linx and iPhone Pairing

- During the initial stimulation appointment patient's Resound Linx 3D 5 BTE aid was linked to the processor via the Cochlear software
  - Device is linked using Noahlink wireless
  - This allows the processor and hearing aid to communicate
  - Without performing this step, the two devices will not communicate
- Paired Cochlear N7 processor to patient's iPhone
  - Patient is now able to control both her hearing aid and the processor from her iPhone screen
  - Capable of streaming phone calls, music, etc. to both ears



<https://www.hima.com/en-us/products/noahlinkwireless.aspx>

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## 1 Week Follow-up Post Initial Activation

- Patient reported that the sound quality has significantly improved
- Data usage revealed patient to be using the device for 10 hours per day
- Excited to tell us that she attended her Christmas church service and was able to hear the music
- Paired Multi Mic to Cochlear N7 processor and Resound Linx 3D 5 BTE
  - Demonstrated and counseled on use of this device



<https://www.cochlear.com/us/recipients/nucleus-6/nucleus-6-accessories/cochlear-wireless-mini-microphone-2-plus>

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## 2 Month Follow-up Post Initial Activation (2/19/18)

- Patient continues to do well with her implant and reports improvements in sound quality and speech understanding
- Programmed Kanso processor as back-up/alternate processor
- Paired Phone Clip to Kanso device for use with iPhone
- Patient informed us that she is now feeling confident enough to return to work as a pharmacist
  - Scheduled appointment with the Office of Vocational Rehabilitation
  - Patient is going to put our office in contact with her new counselor at OVR to provide ideas regarding any necessary accommodations for her at work

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## Possible Phone Solutions

- Pharmacy tech fields phone calls
- Use of 2<sup>nd</sup> iPhone that is used only at work and paired to her devices
- Viewing orders through electronic records
- Captioned phone



<http://captioncallphone.com/>

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## Aided Testing Results Two Months Post Initial Stimulation

Test	Score
HINT sentences in quiet with CI alone	100%
AzBio sentences in quiet with CI alone	78%
CNC words in quiet with CI alone	64%
CNC phonemes in quiet with CI alone	83%
AzBio sentences in +10 SNR with CI alone	52%
AzBio sentences in +5 SNR with CI alone	20%
AzBio sentences in quiet bimodal	97%
AzBio sentences in +10 SNR bimodal	60%

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## What Benefit Does a Bimodal Cochlear Implant Patient Receive from iPhone Streaming and Hearing Assistance Technology?

- Mean word recognition over the telephone improved by 25% in quiet and 23% in noise with the use of the phone hearing assistance technology compared with performance when the cell phone was held next to the microphone of the sound processor. (Wolfe, Morais, & Schafer, 2016)
- Improved performance is similar to improvement found for hearing aid wearers using wireless hearing assistance technology for the cell phone. (Picou & Ricketts, 2011)

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## Bimodal Speech Understanding Benefit

- Results showed that performance in the bimodal condition was significantly better for speech recognition and localization compared to the cochlear implant only and hearing aid only conditions
- Results suggested that all cochlear implant recipients with residual hearing should use a hearing aid in the non-implanted ear

(Potts, Skinner, Litovsky, Strube, & Kuk, 2009)

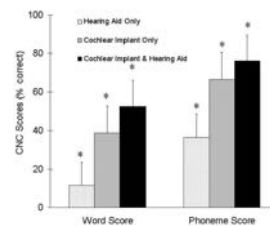


Figure 5. Mean consonant-nucleus vowel-consonant (CNC) word scores (left side of figure) and phoneme scores (right side of figure) in percent correct and  $\pm 1$  SD for the three listening conditions for the running speech-recognition task. The asterisks represent a significant difference between conditions ( $p < .05$ ).

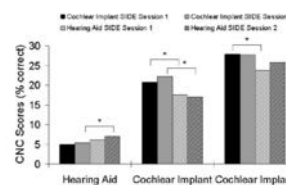


Figure 6. Mean consonant-nucleus vowel-consonant (CNC) word scores (% correct) for the three listening conditions for the running speech-recognition task divided by the side of the loudspeaker array that presented the word for Session 1 and Session 2. The asterisks represent a significant difference for side of presentation ( $p < .05$ ).

From JAAA, used with permission

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## Take aways:

- If you see a patient that already has a cochlear implant, consider which hearing aid would be compatible with that processor
- Not all assistive listening options are always a perfect fit for each patient
- Cochlear implant users with residual hearing should wear a hearing aid in the non-implanted ear

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## Wrap Up

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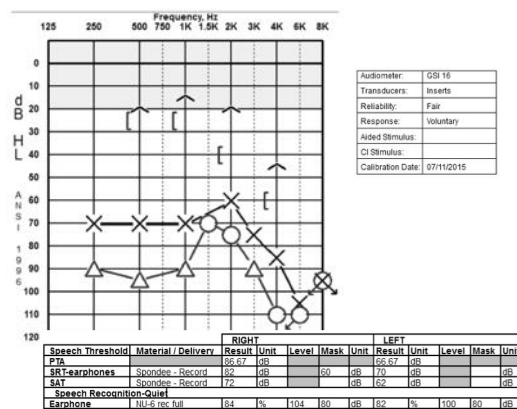
## What do you do when the “Best” Solution isn’t an Option?

AudiologyOnline Grand Rounds - Hearing Aids  
Lori Zitelli, AuD

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## Meet Mr. K

- 61 y/o male; initially seen in otology clinic for CC of hearing loss, ear itchiness, and ear drainage
- PMH: Diabetes, stroke, glaucoma, blindness, unknown ear surgeries
  - 1 ear surgery on the right and 2 on the left.
  - Reasons/procedures are unclear
- Otoscopy:
  - Right: Pinna very stiff. Post-auricular sulcus not well-defined. EAC ends in a blind pouch. Unclear if small amount of TM evident, but doubtful
  - Left: Pinna very stiff. Post-auricular sulcus not well-defined. EAC also narrow and ends at granulation tissue with drainage
- Audiogram today
- Dx: Bilateral stenosis of the external auditory canals and left otitis externa
- Plan: Ciprodex drops for left ear; dry ear precautions; CT scan of the temporal bone to evaluate the status of the external canals, tympanic membrane and middle ears



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## CT scan results

### IMPRESSION:

Bilateral canal wall up mastoidectomies.

Left-sided ossicular reconstruction. The tympanic articulation is not well identified.

Right middle ear cleft soft tissue opacification noted surrounding the stapes and extending along the cochlear promontory to just under the right facial nerve along its horizontal segment. No clear associated erosions.

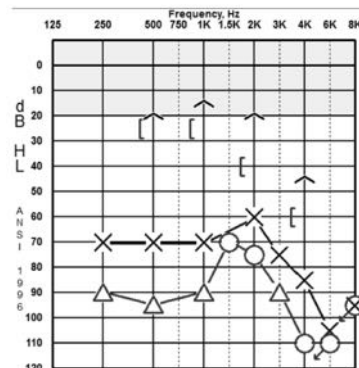
- Discussion w/ otologist of treatment options:
  - Bone conduction hearing aid (osseointegrated or with headband)
  - Traditional amplification (air conduction aid)
  - Surgical repair (repairing his stenosis of the right EAC which would require a canal-down tympanomastoidectomy with canalplasty and split thickness skin grafting w/ possibility of repairing left ear if right goes well)
- Referred to audiology for discussion of amplification options

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## What are Mr. K's amplification options?

- Hearing aid (right ear)
- ~~▪ Hearing aid (left ear)~~
- ~~▪ Hearing aid (binaural)~~
- Osseointegrated BC device
- Non-osseointegrated BC device
- AC aid BC oscillator with headband

Left ear not medically cleared for AC HA  
(per otology note, "would almost certainly exacerbate the chronic myringitis and lead to otorrhea/infection")



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## Amplification Discussion

- Continues to be extremely wary of surgery
- Discussed available options for right ear  
(traditional amplification, bone conduction aid)
  - Funding options



<http://www.sonictechnologyproducts.com/superear-se5000>



<http://www.coaknereproducts.com/gentex-smoke-detector-with-ceiling-mount-model-71350uc-71350uc>

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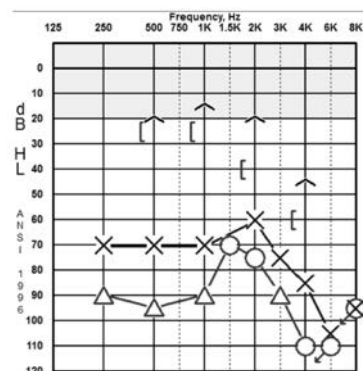
## What are Mr. K's amplification options?

- Hearing aid (right ear)
- Hearing aid (left ear)
- Hearing aid (binaural)
- Ossointegrated BC device
- Non ossointegrated BC device
- AC aid w/ BC oscillator with headband

Left ear not medically cleared for AC HA  
(per otology note, "would almost certainly exacerbate the chronic  
myringitis and lead to otorrhea/infection")

Pt unwilling to undergo surgery

Without surgery, device not billable to insurance (pt  
unable to assume out of pocket cost)



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## Amplification Discussion (cont')

- Pt was approved for Lion's Club funding
  - One aid, specific manufacturer and level of technology, BTE style
- Right EMI taken as deeply as possible
  - Focus on power due to severity of AC loss = power BTE



<http://www.palions.org/index.htm>

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## (Attempted) Delivery #1

- Note: This is where my relationship with Mr. K begins!
  - I inherited him from another audiologist.
- Mold seemed to fit ok, although...
  - Remember when I said Mr. K's pinnas are very stiff and the postauricular sulcus is not well defined?

Postauricular sulcus is the space between your pinna and your head



+



=

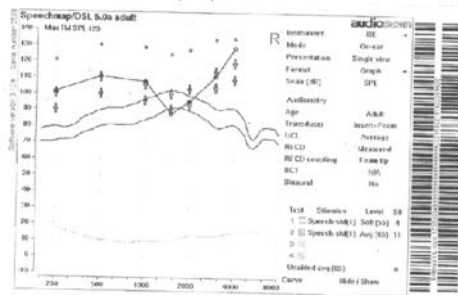
NO VACANCY

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continued

## (Attempted) Delivery #2

- Lion's Club graciously allowed switch to ITE
- Attempted delivery of right full shell ITE (HA #2)
- Physical fit seemed ok from the outside...
- Completed RECD and REAR measurements.
- **YIKES!**
- Discussed ordering different manufacturer ITE in the hopes of getting more power and better feedback control....?

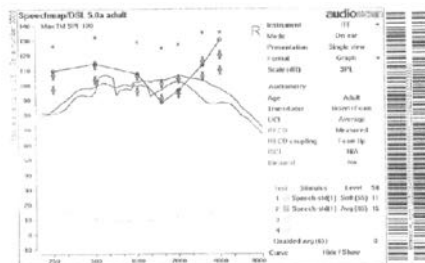


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continued

## (Attempted) Delivery #3

- Attempted delivery of right full shell ITE (HA #3)
- **DOUBLE YIKES!**
- Discussed the following options with pt:
  - Keep FS ITE with less-than-optimal programming
  - Try AC/BC aid with headband
  - Osseointegrated BC device (you can't say I didn't try...)
- Ordered Sumo DM BTE with headband from Oticon



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## What are Mr. K's amplification options?

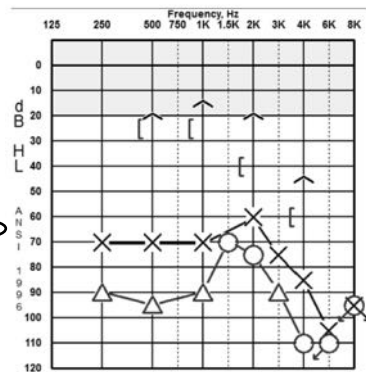
- ☐ Hearing aid (right ear)
- ☐ Hearing aid (left ear)
- ☐ Hearing aid (binaural)
- ☐ Ossoco-integrated BC device
- ☐ Non-ossoco-integrated BC device
- ☒ AC aid w/ BC oscillator with headband

Left ear not medically cleared for AC HA  
(per otology note, "would almost certainly exacerbate the chronic myringitis and lead to otitis media/infection")

Pt unwilling to undergo surgery

Without surgery, device not billable to insurance (pt unable to assume out of pocket cost)

Can't achieve appropriate audibility with traditional aid

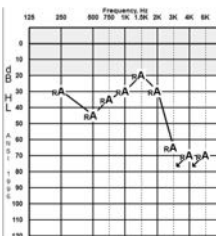


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## Delivery #4

- Delivery of power BTE with bone conduction headband
- Thankfully, Oticon provides a fitting guide
- Phone
- Pt was very pleased with device and was scheduled for 3-week follow-up.

COMPONENTS REQUIRED: 1) Sumo DM 2) Headband/Cord and 3) Oscillator



### FITTING GUIDELINES

#### Genie Settings (as a starting point):

- Overall Loudness: Set to "10"
- Volume Control: Check Enable; Set Reserved gain = 10.
- Identity Selector: Select "Classic (Jing)"
- Adjust MPO & Gain: Select "Quick" view (tab located at bottom of screen), select "A1" in the control grid and increase values to maximum (MPO, Loud, Speech and Soft).
- Reduce Low Frequencies: Select the LF column (for Loud, Speech and Soft) and reduce value to "50" (to avoid distortion).
- Deactivate Automatics: Select "Expanded" view. Compression Time is set to "Default" and Threshold Noise Management is set to "Off". Adjust Volume Control if feedback occurs.

Oticon Bone Conduction Fitting Guide, Sumo DM

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continued

## 1 year later...

- The device had not been functioning for the past 4 months.
- Pt had been unplugging and re-plugging the wired portion of the device daily which caused it to break.
- The band of the device was hurting his head...
  - Could he use a softband?
- The battery door of the BTE was detached and the end portion of the device was cracked. → Sent for repair

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continued

## 3 weeks later...

- Unfortunately, the device is not compatible with a softband.
  - Take breaks throughout the day?
  - Something like Cochlear Americas SoundArc?
  - Use moleskin as a cushion?
    - Caveat: dampened response
- Contact us if device is not working appropriately!



<https://www.cochlear.com/us/recipients/baha-5/baha-5-accessories/soundarc>

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## Take aways:

- Patients with dual-sensory impairment present a unique set of challenges.
- Sometimes we are put into situations where we have to do the best that we can with what we're given.
- It's not always about the *best* option – sometimes it's about the *better* option.

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## Wrap Up

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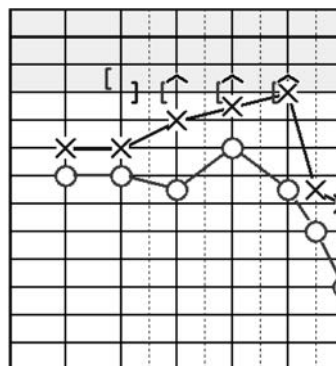
## When what you Always Say Is Impossible Actually Happens

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Virginia Milne, AuD

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## Meet Mrs. C

- 68 year old female; monaural right user of BTE
- Scheduled for HA check
  - Patient reports right hearing aid is weak
- PMH: Treacher-Collins Syndrome
  - No ear surgeries, longstanding mixed right hearing loss known to clinic for 2 years at this point
  - Audiogram on side is from initial intake
- Otoscopy:
  - Right: EAC full of dried blood; large TM perforation visible; ossicles visible
  - Left: EAC clear, TM intact and WNL
- Consulted and immediately referred for consult with in office ENT



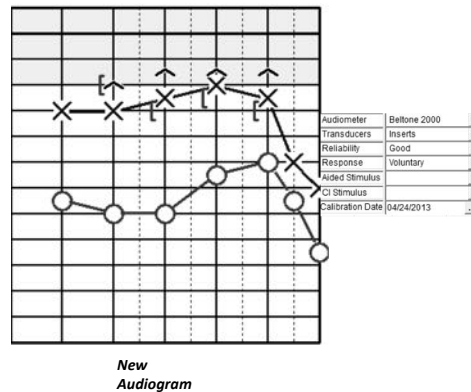
Baseline  
Audiogram

Audiometer	Beltone 2000
Transducers	Inserts
Reliability	Good
Response	Voluntary
Aided Stimulus	
CI Stimulus	
Calibration Date	07/14/2011

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## ENT Evaluation

- Microscopic Exam: demonstrates right large posterior tympanic membrane perforation no drainage at this time
  - At this time, patient noted pain a week or so ago when inserting slim tube BTE with dome
- ENT referred back for Audiogram
  - Audiogram available on the side
- Also recommended that patient not wear hearing aid during 2-3 weeks of healing



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## What happened?

- What we always tell patients is impossible
  - Pushed her slim tube through her ear drum
- ENT indicated she was lucky she didn't cause a disarticulation of her ossicles
- How was this possible in Mrs. C's case?
  - Cranio-facial abnormalities which caused her tympanic membrane to be closer to the entrance to the EAC
  - Patient never noted severe pain, just minor pain and a weaker hearing aid
    - Did not note change in hearing until we discussed results of audiogram

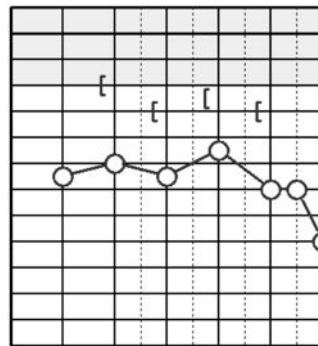


<https://www.oticon.global/support/how-to/put-on-remove-hearing-aid/bteccda>

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## 2 weeks after perforation

- ENT Evaluation
  - Pt reports no pain or drainage from right ear
  - Microscopic Evaluation: right perforation almost completely healed
- Audiologic Evaluation
  - Right pure tone thresholds returned to level of 2 year old baseline audiogram
- Recommendations
  - Follow-up in 2 weeks to assess healing of perforation



*Follow-up Audiogram*

Audiometer	Beltone 2000
Transducers	Inserts
Reliability	Good
Response	Voluntary
Aided Stimulus	
CI Stimulus	
Calibration Date	04/24/2013

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## 4 weeks after perforation

- ENT Evaluation
  - Microscopic Examination: right perforation completed healed, cleared for ear impression if needed
- Recommendations
  - Discontinue use of slim tube with dome and determine safer way for Mrs. C to continue using right amplification
- Audiologic Consult
  - Discussed safety concerns moving forward with amplification

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## What are Mrs. C's options?

- Continued Slim Tube Use
- Earmold
- Custom Hearing Aid
- Discontinue HA use
- Bone anchored hearing aid

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## Decision

- Decided to switch slim tube to earmold due to concern that this could happen again
- Ear impression taken without incident
- Ordered canal lock acrylic earmold with large vent
- Fit with earmold and reprogrammed hearing aid 2 weeks later to accommodate new acoustic parameters. Patient noted comfortable fit and good sound quality and REM demonstrated appropriate audibility

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continued

## 18 months later...

- Patient comes in asking for a slim tube to be put back on her hearing aid
  - Why?
    - Cosmetics
    - Feedback from loose earmold
- Advised Mrs. C of the risks given her circumstances and heavily recommended that we continue using an earmold.
  - Also, decided to order a new earmold as it was clear that her ear had grown/changed shape as it had not previously been loose
  - Advised patient that she may need new earmolds frequently due to her craniofacial condition

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continued

## Take aways:

- The impossible is possible
- Cosmetics can sometimes trump safety to patients unless reminded of the risks
- It is possible (under certain circumstances) to push a slim tube with a dome through your eardrum
  - And even not know that you did so until you see an ENT and/or audiologist

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continued

## Wrap Up

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continued

## Realistic Expectations: A Better Predictor of Outcomes Over Candidacy Criteria?

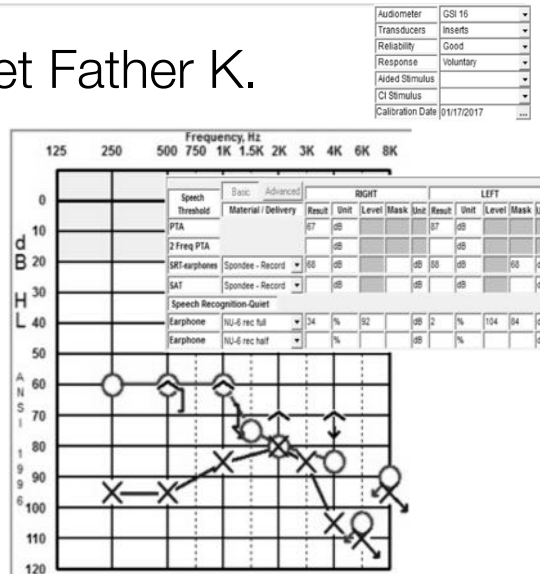
AudiologyOnline Grand Rounds - Hearing Aids  
Corrine Pfaff, AuD

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continued

## Meet Father K.

- 78 y/o male; initially seen in otology clinic December 22, 2007 for CC of hearing loss, dizziness, and tinnitus
- Primary Medical Health:** leukemia, prostate cancer, hypertension, type 2 diabetes and coronary artery disease
- Otological History:** He denies otalgia, otorrhea, recurrent infections or other otologic complaints, stapedectomy in the 1970's right ear and recently stapedectomy 1/30/17 for mixed left side otosclerosis
- Amplification History:** HA on right ear only, 9/16/13 Fit with right unilateral BTE canal lock custom mold and slim tube
- Most recent audiogram completed 3/30/2017



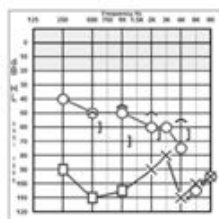
71

continued

## Serial Audiograms

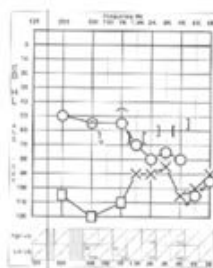
8/15/13

Initial audiogram at UPMC prior to HA on the right



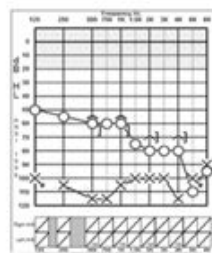
8/7/15

Same aid- updated audiogram & speechmapping  
\*Met with otology shortly after



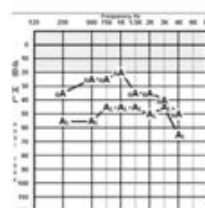
8/12/16

Otologic F/U  
Presented with options.  
Rx CI candidacy testing



10/27/16

Aided testing at CI appointment



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## CT scan results

9/30/2015 - CT Maxillofacial: There is evidence of a Robinson prosthesis on the right ear in nice placement. There is potential evidence of otospongiotic bone bilaterally, but it is difficult to say for certain.

- Discussion w/ otologist of treatment options:
  - BiCROS
  - Traditional amplification right side only
  - Surgical repair (stapedectomy left and/or cochlear implantation afterwards if not improved WRS)
  - With stapes The goal would be to attempt to make the left ear audible. If he does not end up having stapes fixation, or the procedure is not a success, he will remain a cochlear implant candidate.
- Referred to audiology for discussion of amplification options after stapedectomy

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## Just to review...What are Father K's options?

- New right side HA
- BiCROS (hearing aid right ear, transmitter left ear)
- Left Stapedectomy + Right HA
- Left cochlear Implant + Right HA
- Continue to use current right HA
- Bimodal stimulation

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## 1<sup>st</sup> Amplification Discussion

5/2/17

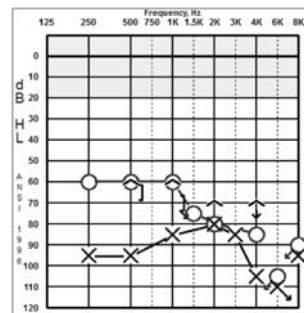
- Found left stapes surgery to be helpful but not successful enough to be aided on that side
  - Discussed available options for right ear (traditional amplification, BiCROS option)
  - He has tried multiple hearing aids on the left, including a CROS-type device ("none of which worked/found benefit")
- \*\*Patient left undecided, he chose to take time to think about his options.

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## What did Father K decide to do?

- New right side hearing aid
- ~~BiCROS (hearing aid right ear, transmitter left ear)~~
- ~~Left cochlear Implant~~
- ~~Continue to use current right hearing aid~~
- ~~Left Stapedectomy- 1/30/17~~

Patient was then scheduled for a continued amplification discussion and appointment to make an earmold impression of right ear.



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continued

....After appointment with otologist (8/1/17), patient decided to pursue a CROS device for the left side. Ordered compatible CROS II with CROS tube for the left.

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continued

## 3 Week Check & Delivery #2

9/1/17

- Had some difficulty inserting standard shell mold but with practice has improved.
- Reported good speech understanding (realistically) with his better ear at 34% WRS.
- Noted significant improvement with properly fit amplification and coupled custom mold in everyday life.
- CROS II added to fitting. Patient to follow-up in 3 weeks to assess benefit of BiCROS

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continued

## 3 weeks later...

10/3/17

- Unfortunately, the BiCROS set-up was no more beneficial than a unilateral right hearing aid.
  - Father K. used the BiCROS diligently in multiple environmental scenarios with both the transmitter on and off.
  - He gave the BiCROS time to see if adaptation was necessary to its success.
- Patient chose to continue wearing only his unilateral right hearing aid and supplement with hearing loss self advocacy and hearing loss better communication strategies.

B1

continued

## Take away...

- Sometimes a procedure or device is not beneficial when something more simplistic provides an improvement in quality of life.

B2

continued

## Wrap Up

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continued

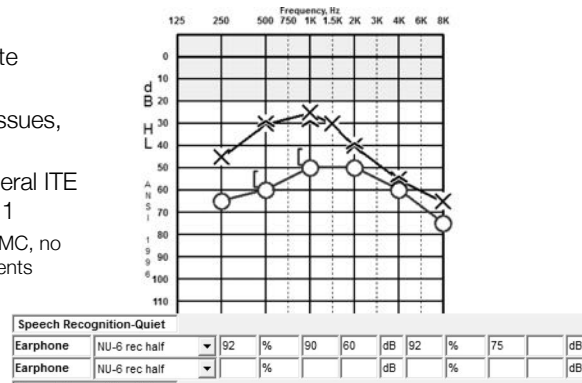
## An Approach to Amplification for Active Meniere's Disease

AudiologyOnline Grand Rounds- Hearing Aids  
Megan Keirans, AuD

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## “George”

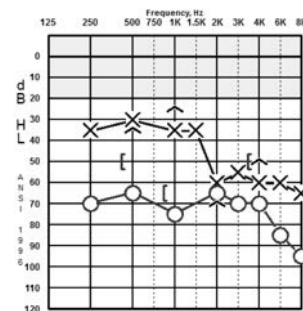
- 80 year old male
  - Stable mild to moderate SNHL (R>L)
  - No hx of tinnitus, ME issues, dizziness
  - Successful use of bilateral ITE hearing aids since 2011
    - Purchased outside UPMC, no programming/adjustments completed on site



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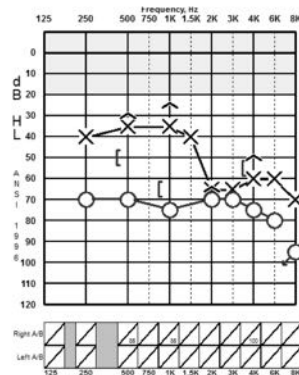
## Onset of Vestibular Issues and Increased Hearing Loss (R)

- Initial encounter 2015
  - Presented to ED with severe dizziness and vomiting lasting 4-10 hours, 13 episodes over 5 wks
  - Tinnitus (R)
  - Decreased hearing that fluctuates daily (R)
  - Negative MRI; all other testing unremarkable
  - Referred to ENT
- Vestibular Evaluation with Neuro-otologist 2015
  - Dx: audiologic/vestibular battery and symptoms suggestive of endolymphatic hydrops
  - Began VRT and use of Maxzide with dietary changes
  - Rec. continued use of amplification



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## Current Audiogram (10/2017) and Otologic Symptoms



- Episodes of vertigo lessened in frequency and severity since 2015
  - Continued Maxzide use daily
  - Low caffeine/salt intake
- Recent episodes of severe vertigo and vomiting over the past 3 weeks
  - Decreased hearing (R) that is fluctuating
  - Onset of Fullness (R)
  - Tinnitus more severe (R)
  - Concerned loud sounds trigger episodes
- Negative CT head in ED

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## Steady decline in word recognition bilaterally...

	RIGHT	LEFT
2011	92%	92%
2015	80%	88%
5/2016 (onset of dizziness)	40%	76%
3/2017 (during episode)	26%	32%
10/2017 (during episode)	20%	44%

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## Common Issues

- Fluctuating hearing loss
  - Low-frequency upward sloping sensorineural
- Poor word recognition
  - Can fluctuate in some people
- Recruitment/reduced dynamic range
- Aural Fullness
- Bothersome Tinnitus
  - Low-frequency, “whooshing” in nature
- Difficulty in background noise
- Debilitating Vertigo
  - Varies in severity
  - Often in addition to nausea, vomiting, etc.

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- ~~Debilitating Vertigo~~
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  - Often in addition to nausea, vomiting, etc.

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## Hearing Aid Appointment

- Not interested in updating hearing aid technology
  - Purchased full shell ITE hearing aids in entry-level technology from outside clinic in 2016
  - Unaware if real ear measurements were completed
    - EAC revealed underfitting compared to expected gain using  $\frac{1}{2}$  and  $\frac{1}{3}$  gain rule
- Reported Issues:
  - Listening in background noise
  - Fluctuating/decreasing WR (R>L)
  - Bothersome whooshing tinnitus R ear
  - Pt sensitive to louder sounds in affected ear
    - Using earplug in public
  - Debilitating vertigo is main concern, pt feels fatigued from listening effort in addition to episodes of vertigo
    - Pt's activity and participation are limited during episodes, hoping to increase QoL during episodes

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## Amplification Considerations

- Volume Control
- Multiple programs/memories
  - Program various levels of amplification to address fluctuations
- Consider BiCROS system due to affected speech clarity score
- Use of tinnitus sound generator program
- Focus on verifying optimal audibility for non-fluctuating ear
  - Stable hearing thresholds
  - Better speech understanding score
  - No bothersome tinnitus
- Consider assistive listening devices

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## Assistive Technology

- George lies on couch and rests during episodes of vertigo
  - Unable to ambulate; experiences nausea, vomiting
  - Lays on R side; keeps L ear non-occluded by pillow
  - Fluctuating/decreased WR = challenge to understand TV dialogue
- Consider TV/Media streamer
  - Wireless bilateral streaming
    - Ability to lie on side on couch and still listen bilaterally
    - Ability to utilize both ears or only stream to L ear if R WR decreased significantly/George removes R HA
  - Can close eyes and listen rather than rely on CC

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## Updated Programming with Verification

- REAR completed and DSL adult targets reached bilaterally through 4,000 Hz
- Programs added
  - Unable to verify HA settings for differing threshold fluctuations without serial audiograms captured during active episodes
  - Using P1 (verified), generated 2 additional settings of increased gain to address fluctuations
- Volume control
  - Activated wheel VC bilaterally (with uncoupled individual control)

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## Updated Programming with Verification

- Tinnitus generator?
  - Not possible in current devices
- Counseling
  - Avoid use of earplug for sound aversiveness in R ear when pt unable to use R HA due to distortion/discomfort
  - Use of different programs/volume settings
  - Discuss communication strategies

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## Take aways:

- Amplification can take backseat when working with patients experiencing active Meniere's Disease
  - Vertigo and tinnitus can often be main concerns
  - Reset goals based on patient's needs and goals
- Consider ways to give multiple gain settings to attempt to accommodate fluctuations
- Adapt current technology to patient's needs if they are unable or do not wish to update devices
  - Use of assistive listening technology to supplement current HAs
- Importance of counseling

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## Wrap Up

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