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Grand Rounds:
Cases in Medical Audiology,
presented in partnership with The Ohio State University

Gail Whitelaw, PhD

Abigail Smiles, AuD

Breanna Langenek, BA

Devan Lander, BS

Hailey Long, BA

Theodora Bowman, BA

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Gail Whitelaw, PhD

Gail M. Whitelaw, Ph.D., is a clinical associate professor in the AuD program and the director of the Speech-Language-Hearing Clinic at The Ohio State University in Columbus, OH. Her areas of clinical interest are tinnitus, auditory perception in children and adults, educational audiology, and working with people with HD (hearing deficits-- those with functional auditory complaints). She has consulted to many school districts throughout the county. Dr. Whitelaw has also worked with children and their families in developing educational plans and goals for children with auditory processing disorders.

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Abigail Smiles, AuD

Abigail Smiles, AuD (they/them) is a recent graduate of The Ohio State University. Dr. Smiles completed their 4th-year externship with the VA Puget Sound VA Healthcare System in Seattle and Tacoma, WA. Their clinical interests include audiologic rehabilitation for patients with TBI, adult auditory processing disorder, and the use of mild-gain amplification for treatment of suprathreshold listening deficits.
Dr. Smiles currently resides in Victoria, BC, Canada with their husband and cat.

Breanna Langenek, BA

Breanna Langenek is a third-year AuD student at The Ohio State University. She graduated from The Ohio State University in 2021 with a BA in Speech and Hearing Science with a minor in pharmaceutical sciences. Breanna is currently completing an NIH T-35 research traineeship under the mentorship of Dr. Konrad-Martin at the National Center for Rehabilitative Auditory Research (NCRAR) in Portland, Oregon. Breanna's professional interests include research, ototoxicity monitoring, hearing conservation, and interdisciplinary practice.

Devan Lander, BS

Devan Lander is a 5th year Au.D./Ph.D. student at The Ohio State University. Her interests include auditory processing deficits, cognition, subjective hearing difficulty, and hearing aids. She really enjoys working with patients who have a history of traumatic brain injury and subjective hearing difficulty, something she has personally experienced. Devan is interested in pursuing clinical research and working with students to continue to develop future clinicians.

Hailey Long, BA

Hailey Long is a third-year audiology student at The Ohio State University. She completed her Bachelor of Arts in speech and hearing science at Cleveland State University. Hailey is interested in tinnitus patients and pediatric audiology. She is a LEND trainee in audiology at the Nisonger Center at Ohio State for the 2023-2024 school year.

Theodora Bowman, BA

Theodora Bowman is a fourth-year Doctor of Audiology student at The Ohio State University. She is currently completing her fourth-year externship at ProMedica Audiology in Toledo, OH. She graduated from the University of Florida in 2020 with two degrees in speech & hearing science, and psychology. Her clinical interests include both pediatric and adult populations, tinnitus, interdisciplinary practice, and psychosocial impacts of hearing loss.

Disclosures

- **Presenter Disclosure**: Financial: Gail Whitelaw is an employee of the Ohio State University. Non-financial: Gail Whitelaw is a Board member of Audiology Practice Standards Organization; Advocacy Chair, the American Academy of Audiology; Board member Accreditation Commission for Audiology Education (ACAE). Financial: Abigail Smiles has no relevant financial relationships to disclose. Non-financial: Abigail Smiles has no relevant non-financial relationships to disclose.Financial: Breanna Langenek has no relevant financial relationships to disclose. Non-financial: Breanna Langenek has no relevant non-financial relationships to disclose.Financial: Devan Lander has no relevant financial relationships to disclose. Non-financial: Devan Lander has no relevant non-financial relationships to disclose.Financial: Hailey Long has no relevant financial relationships to disclose. Non-financial: Hailey Long has no relevant non-financial relationships to disclose.Financial: Theodora Bowman has no relevant financial relationships to disclose. Non-financial: Theodora Bowman has no relevant non-financial relationships to disclose.AudiologyOnline has made a donation to the audiology program at The Ohio State University Student Academy of Audiology for this presentation.
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Learning Outcomes

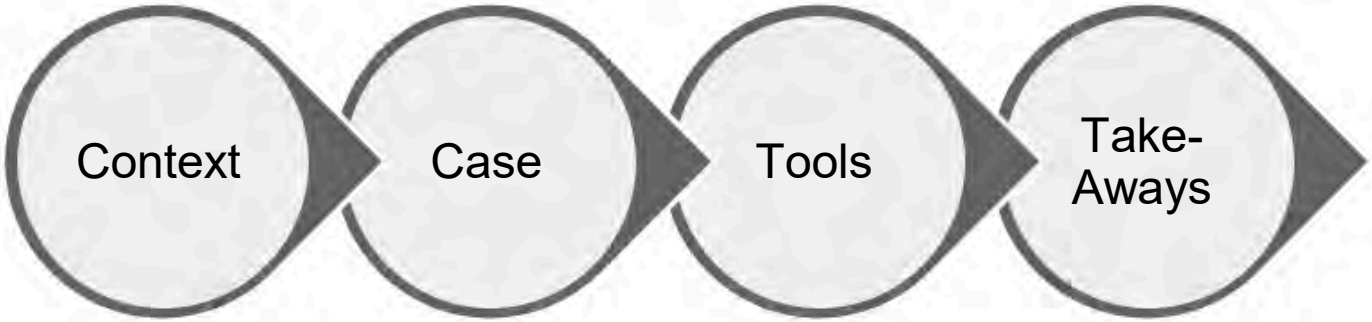
After this course, participants will be able to:

- Describe the critical role of audiology in supporting differential diagnosis based on hearing and balance care provided.
- Discuss considerations in addressing the person as a whole and their hearing/balance/communication needs.
- Describe the importance of Interprofessional Practice (IPP) in clinical care.

Traumatic Brain Injury with Concurrent Facial Palsy: A Unique Case

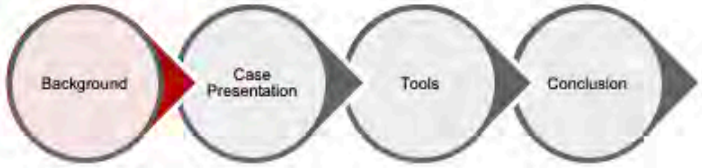
Devan Lander, AuD/PhD Candidate

The Ohio State University


Context
Case
Tools
Take-Aways

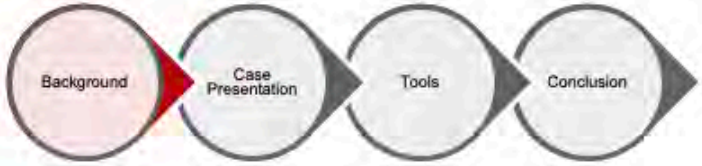
Background:
Traumatic Brain Injury (TBI)

- Traumatic Brain Injury (TBI) has a high incidence in the U.S. population and is known as a silent epidemic[1].
- May have persistent auditory complaints including[2]:
  - ✓ hearing in background noise
  - ✓ difficulty hearing in groups
  - ✓ difficulty understanding rapid speech
- May face disruptions in their functional communication.[3,4]
- Hearing difficulty is likely to go undetected by the conventional audiometric battery.
  - ✓ challenges remembering spoken information or instructions
  - ✓ auditory fatigue.



Background: Facial Palsy

- Facial palsy refers to weakness or paralysis of the facial muscles[5].
- Facial nerve function – *review*
- Physical and emotional consequences[5]:
  - Lack of control over ocular structures, interruption of the acoustic reflex, difficulty eating & drinking.
  - Dental issues, facial pain, difficulty with speech production, and facial spasms.
  - Decreased self-esteem, increase rate of anxiety & depression, stigma & difficulty communicating.



Background: TBI & Facial Palsy

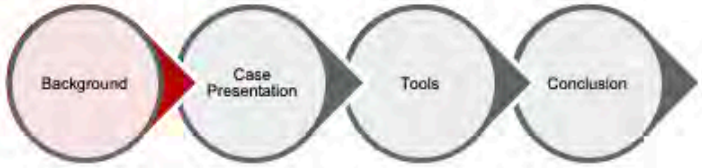
- Facial palsy immediately or have a delayed onset following TBI
- Typically occurs within 72 hours of incident
- May be accompanied by:

01 **Pain**
Face, mastoid, ear

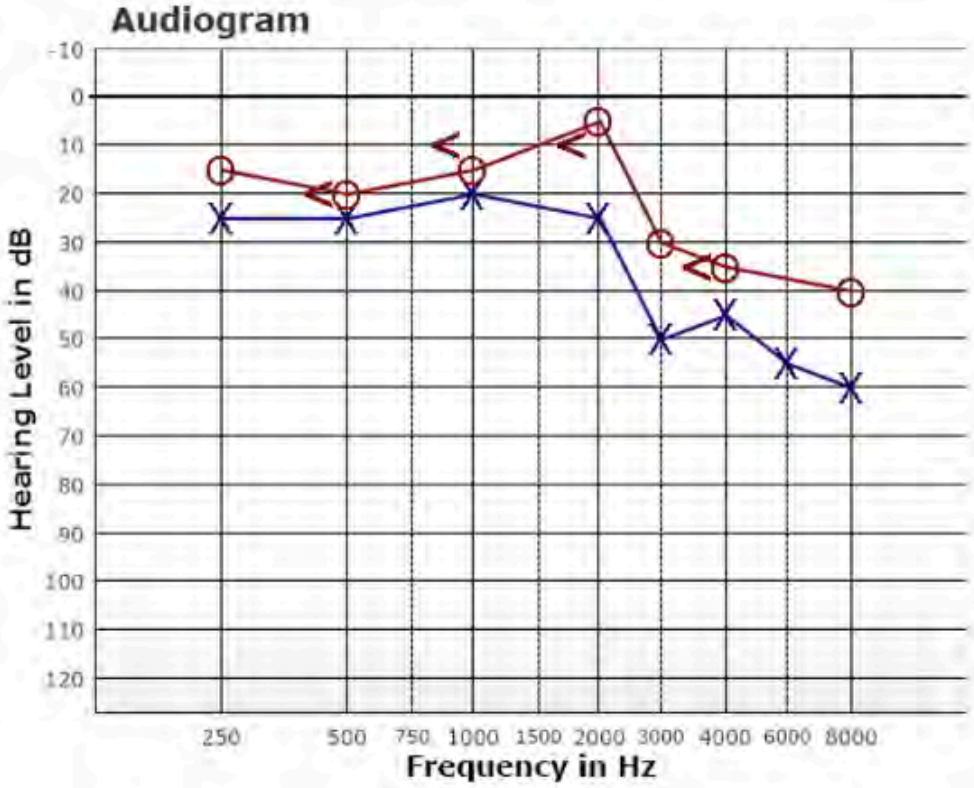
02 **Altered Taste**

03 **Hearing Loss**

04 **Altered Facial Sensation**



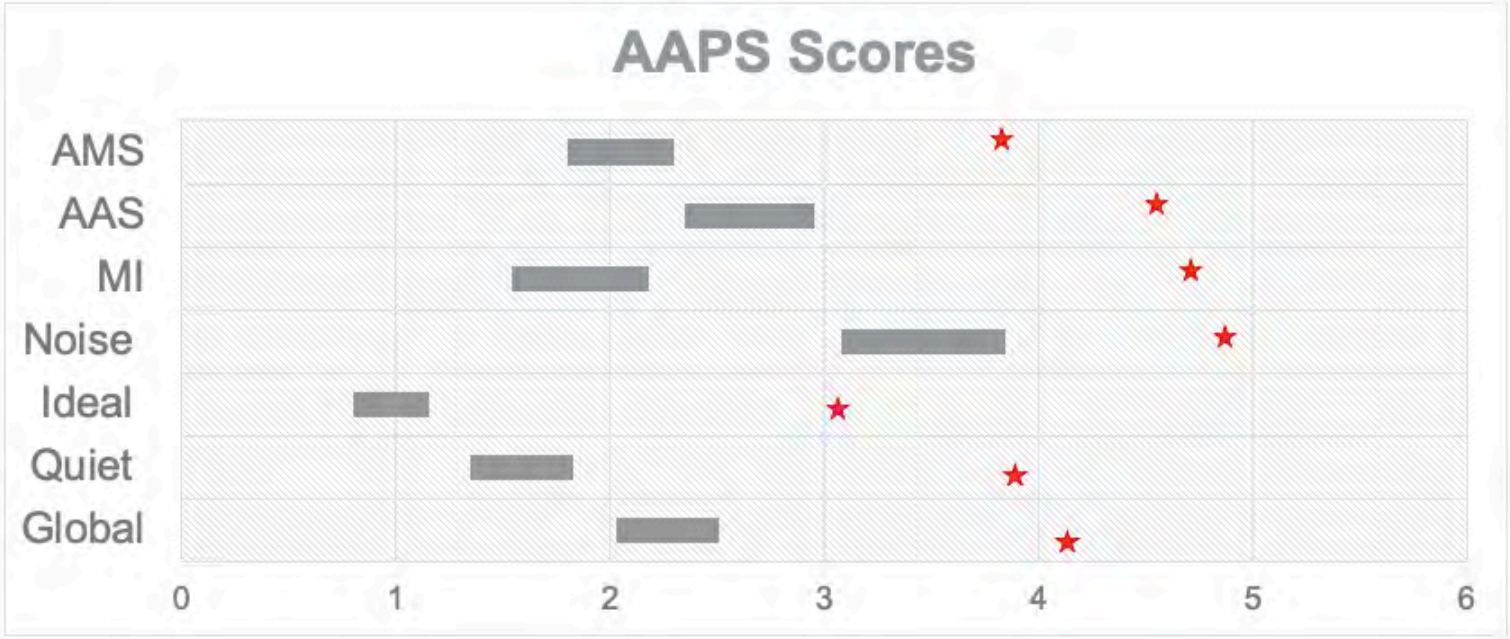
Case: Case History



- MVA in 2022
- Reports hearing difficulty & memory loss
- Reports occasional bothersome tinnitus
- Other treatment (until Sept. 22'):
  - Speech-language therapy
  - Physical therapy
  - Occupational therapy

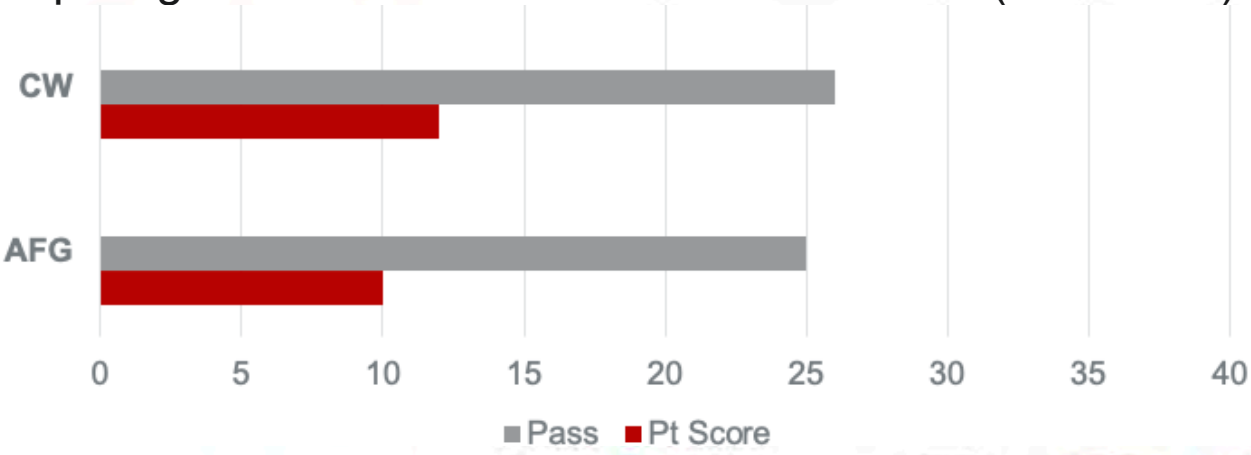
Case: Testing Results

- Adult Auditory Processing Scale (AAPS)[6,7]



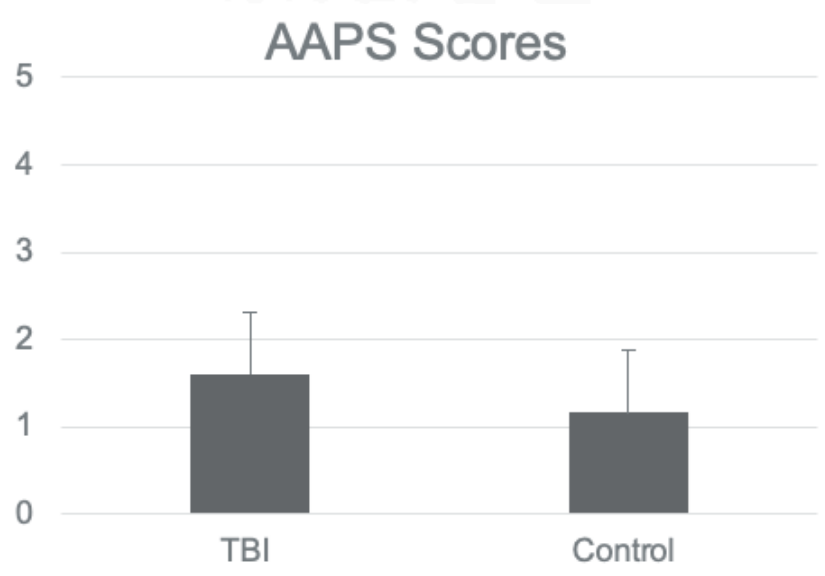
Case: Testing Results (cont.)

- Note: *Test Anxiety*
- SCAN-3 Screening Results – *Failed*
  - Gap Detection- could not consecutively detect gaps
  - Auditory Figure-Ground 0- Raw Score: 10 (Pass ≥ 25)
  - Competing Words – Free Recall- Raw Score: 12 (Pass ≥ 26)



Tools: Testing Strategies

- Combination of behavioral & subjective measures
- Preliminary AAPS Data in Young & Middle-Aged Adults
  - Individuals with a history of TBI significantly greater scores than a control group.
  - Scores on the AAPS are correlated with performance on speech-in-noise performance (LiSN-S), auditory working memory (WARRM), and temporal processing (MLD)



Tools: Individual Variability

Subject	Task 1	Task 2	Task 3	Task 4	# of Abnormal Tasks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Conclusions

1. TBI can be accompanied by a wide array of other disorders and symptoms.
2. Addressing auditory difficulty may be occur after the acute period.
3. Using a combination of subjective and objective testing may be more sensitive to revealing an auditory difficulty.
4. Every person with a history of TBI is unique.

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Traumatic Brain Injury: What is the Audiologist's Role?

Abigail J. Smiles, Au.D.
The Ohio State University

Agenda:

- Brief review of TBI
- Case overview: “Ms. M”
- Audiologic assessment results
- Treatment of suprathreshold listening deficits, tinnitus, and sound tolerance disorders in patients s/p TBI
- Post-treatment follow-up
- Special considerations for audiologists working with the adult TBI population

TBI Primer for the Audiologist

- TBI is broadly defined as any injury that results in disruption of the typical functioning of the brain
  - Can be further defined by the mechanism of injury, severity of injury, and global damage vs. cellular damage
- Although TBI is highly variable, common auditory and vestibular sequelae following TBI include peripheral hearing loss (although not always!), auditory processing disorder, balance disorders, tinnitus, and sound tolerance disorders (ex. Hyperacusis)
- Non-auditory sequelae that may impact listening and communication include deficits in memory, receptive/expressive language, attention, and executive function

(CDC, 2015; Capizzi, Woo, and Verduzco-Gutierrez, 2020; Gallun, 2017)

Meet the Subject: “Ms. M”

- 34-year-old female s/p mild traumatic brain injury (mTBI) that occurred in November 2021 during a motor vehicle accident (MVA)
- Acute medical management included 1-day hospitalization
- Rehabilitation services included speech and language therapy and vision therapy
- Months after MVA, Ms. M continued to experience significant communication difficulties and auditory symptoms, including abnormal sound tolerance, bothersome intermittent tinnitus, and perceived difficulties listening in noise

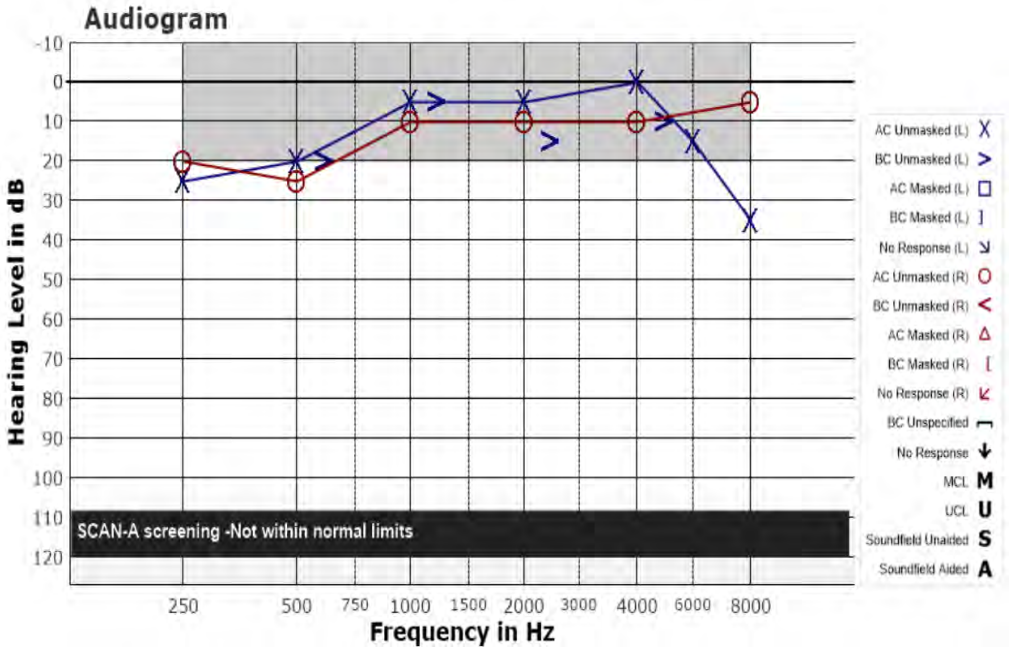
Referral to Audiology

- First appointment at The Ohio State University Speech, Language, and Hearing Clinic (OSU SLHC) on 03/09/2022
- Ms. M reported that goals for audiologic treatment included:
  - Reducing distress from sound tolerance disorder and tinnitus
  - Improving listening abilities, especially in background noise
  - Return to work as a high school teacher

Audiologic Assessment

- Case Hx
- Completion of questionnaires
  - Tinnitus Reaction Questionnaire (TRQ; Wilson, Henry, Bowen, and Haralambous, 1991)
  - OSU SLHC Hyperacusis Intake Questionnaire
- Otoscopy/Immittance
- Audiometry:
  - Pure-tone thresholds (AC and BC)
  - Speech audiometry (SRT and WRS)
  - R-SPIN
  - Auditory processing evaluation (SCAN:3-A)

Results of Assessment



- Speech Audiometry:
- SRT:
  - 5 dB HL bilaterally
- WRS:
  - 100% bilaterally at a presentation level of 55 dB HL

Results of Assessment

- R-SPIN: 76% High-Predictability (HP) words, 0% Low-Predictability (LP) words
- SCAN:3-A revealed global auditory processing deficits

Subtest	%ile Rank
Auditory Figure Ground +0	1
Filtered Words	1
Competing Sentences	0.1
Time-Compressed Sentences	0.1
Competing Words – Free Recall	5
Competing Words – Directed Ear	DNT

Where Do We Go From Here?

- Essentially-normal peripheral hearing sensitivity for pure-tone stimuli (mild HL at 8000 Hz only in LE)
- Normal word recognition performance in quiet
- HOWEVER:
  - Significant self-reported difficulties with listening/speech understanding, sound tolerance, and tinnitus
  - Objective evidence supporting auditory processing deficits

Treatment: Tinnitus and Hyperacusis

- Treatments for tinnitus and treatments for sound tolerance disorders are based on similar principles
- Referral to cognitive behavioral therapy to help manage distress associated with abnormal sound tolerance and tinnitus
- Sound therapy: use of environmental sounds, recorded sounds, and/or music to reduce contrast between tinnitus and environment
  - Goal is NOT to mask or “cure” tinnitus; goal is to promote HABITUATION of tinnitus!

Research: Tinnitus and Hyperacusis Treatment

Sound Therapy:

- Use of ear-level BBN resulted in subjects experiencing noticeable improvements in tinnitus perception over shorter time interval, however, did NOT increase magnitude of treatment effects (Formby, Yang, and Scherer, 2022)

Cognitive Behavioral Therapy:

- Limited evidence; however, one study found that CBT was associated with lower scores on Hyperacusis Questionnaire (Aazh, Landgrebe, Danesh, & Moore, 2019)

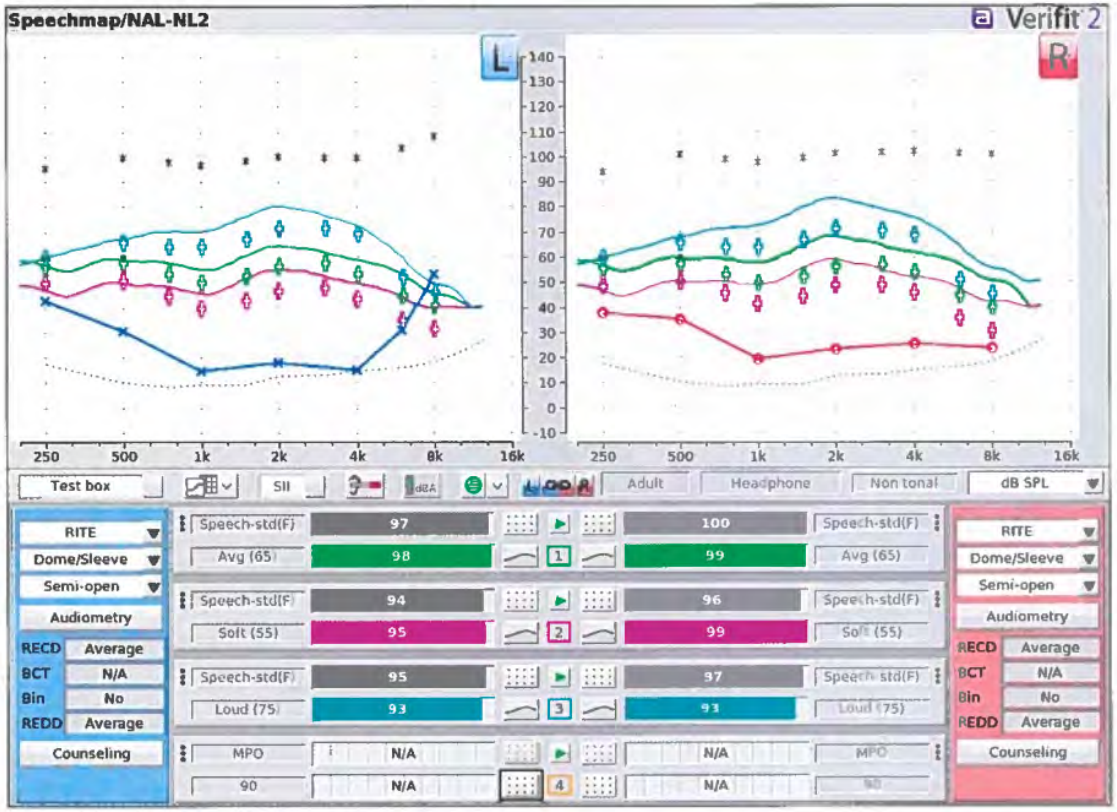
Mild-Gain Amplification

- Goal is to enhance speech understanding in difficult environments by improving SNR and enhancing soft-consonant sounds (Roup, Ross, and Whitelaw, 2020)
- Benefits of mild-gain amplification for individuals with subjective listening deficits may include reduced perception of listening handicap, improved speech-in-noise performance, and reduction in perceived listening effort (Beck, Ng, & Jensen, 2019; Roup, Post, & Lewis, 2018)
- SNR may be further improved through use of ALDs (Gallun, 2017)

Mild-Gain Amplification

- Oticon MORE 1 mRITE hearing aids with 60-dB receivers and double-bass domes
  - Chose occluding style to allow Ms. M to receive full benefits of signal processing and noise reduction features
- NAL-NL2 Prescriptive targets were determined by adding 10 dB to Ms. M's pure-tone thresholds
  - Added additional high-frequency gain to enhance soft consonant sounds and increase speech clarity

Mild-Gain Amplification



Post-Treatment Follow-Up

- Listening in Noise:
  - Ms. M reported significant reduction in perceived handicap and listening effort
    - “These hearing aids have changed my life!”
  - Her family commented that she has appeared “more relaxed” during conversations while wearing mild-gain amplification
  - R-SPIN Results improved from pre-treatment unaided condition to aided post-treatment condition:
    - Aided: 100% HP words, 85% LP words

Post-Treatment Follow-Up

- Tinnitus and Hyperacusis:
  - Reported subjective improvements in severity of tinnitus and sound tolerance issues since start of care with audiology
  - Stated that CBT has been helpful in managing negative emotional reactions to auditory symptoms
  - Post-treatment questionnaires:
    - Reduction in TRQ score from 44 to 24
    - Slight reduction in perceived loudness of environmental sounds reported on OSU SLHC Hyperacusis Questionnaire

TBI: Special Considerations for Providers

- Audiologists interested in this population should have a basic knowledge re: interpreting imaging reports and medical documentation
- Individuals with TBI should be screened for mental health issues, speech/language disorders, and cognitive impairments when appropriate
- Audiologists should be familiar with the scopes of practice of providers in other disciplines and know when to refer
- Consider each individual's cognitive and communicative status and modify communication or test instructions as necessary to ensure patient success
- May need to break up testing into shorter sessions due to patient's level of listening fatigue

Final Thoughts

- TBI is a highly-variable injury that can result in a wide variety of auditory and non-auditory symptoms that can affect communication and participation in activities of daily living
- Audiologists are uniquely qualified to work with individuals with TBI and other neurological disorders involving the auditory system
- Although research into the assessment and treatment of the TBI population is still emerging, this is an exciting area for the advancement of our field!

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Ototoxicity Monitoring: Beyond the Audiogram

Breanna Langenek, B.A.

The Ohio State University

National Center for Rehabilitative Auditory Research

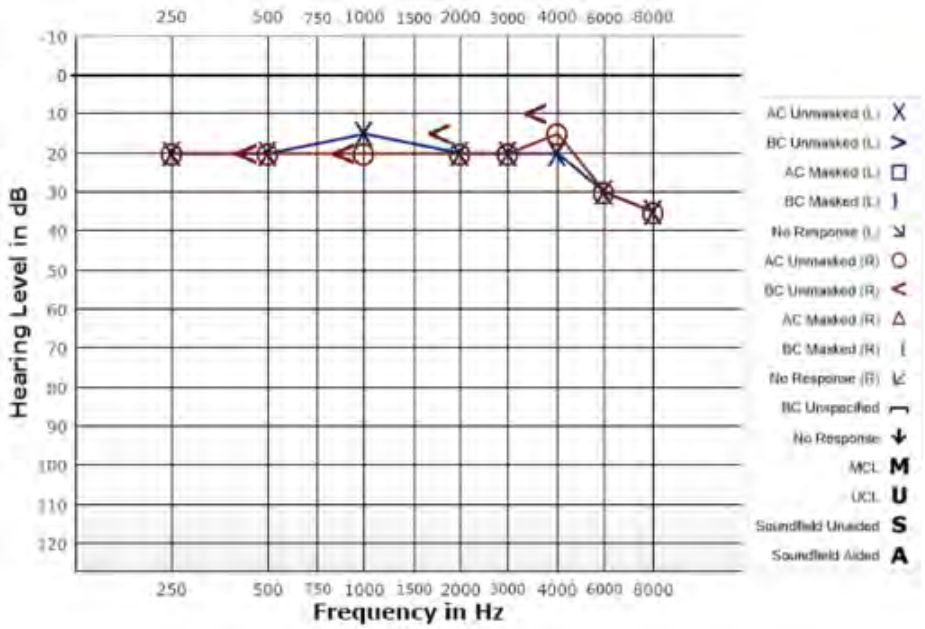
Introduction to Cisplatin Ototoxicity

- Platinum-based chemotherapy agent that can cause damage to the auditory system
- **Use**: treat a variety of solid tumors, such as head and neck cancers (Brown and Tchounwou, 2019)
- **Auditory Effects**:
  - Permanent high-frequency sensorineural hearing loss
    - Hearing loss commonly increases in severity and will begin to impact lower frequencies with continued treatment
    - Can cause damage to the stria vascularis, OHC and IHC (Bregilo et al., 2017)
  - Tinnitus (Sanchez et al., 2023)

History

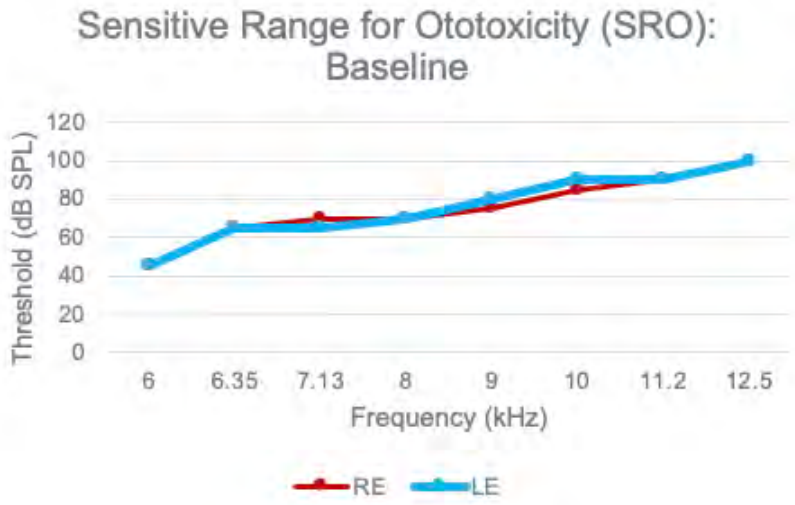
- Male subject in his 60s
- Diagnosis
  - Squamous cell carcinoma of the oral cavity
- Chemotherapy plan
  - Cisplatin 40 mg/m^2 IV once a week for 5 weeks
  - Received ototoxicity monitoring via research study with NCRAR at the Portland, OR VA
    - Followed study protocol

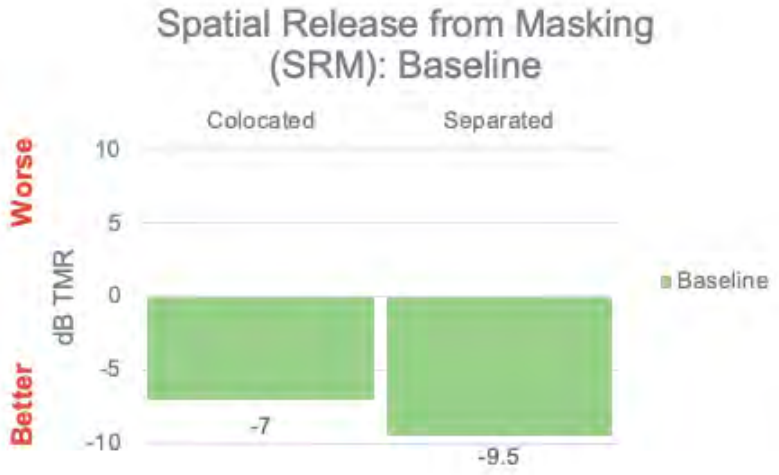
Baseline Results



Obtained prior to starting Cisplatin

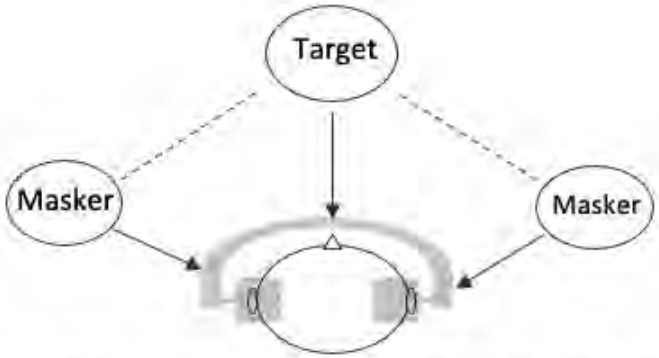
MMSE: Passed
Tinnitus: denied





Spatial Release from Masking (SRM)

- Evaluates the auditory system's ability to utilize *directional cues* in order to separate a target signal from masking sound in colocated and spatially separated conditions
  - Form of speech-in-noise testing under headphones
  - Target to masker ratio (TMR)



Visual Representation of Spatially Separated Target and Masking Talkers (simulated over headphones)

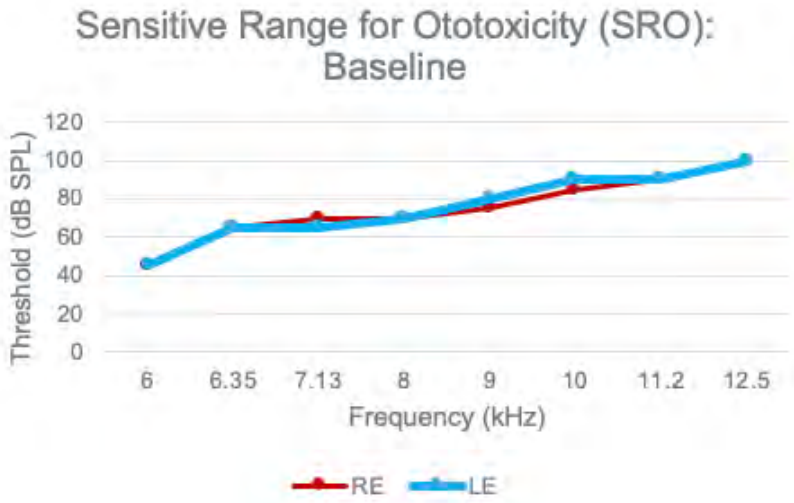
(Lelo de Larrea-Mancera et al., 2022)

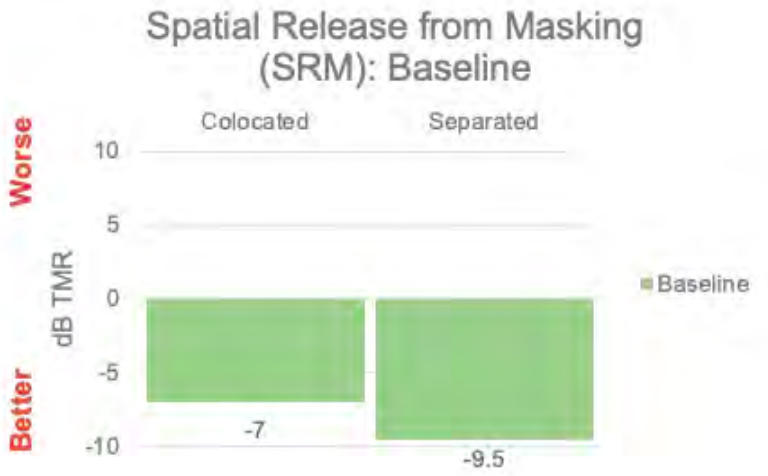
Sensitive Range for Ototoxicity (SRO)

- The SRO looks at the upper limits of hearing
  - Looking for:
    - The highest frequency with a threshold of ≤100 dB SPL
      - Then the 6 adjacent, lower frequencies in 1/6th octave steps
        - Hughson and Westlake procedure
  - Range is unique to each person (Fausti et al., 1994)

- Can detect ototoxicity 90% of the time

Baseline Results





Best possible score: - 10 dB TMR
Worst possible score: 10 dB TMR

Visit 2

- 30 days after baseline
  - One weekly dose of Cisplatin remaining
  - No change perceived by subject

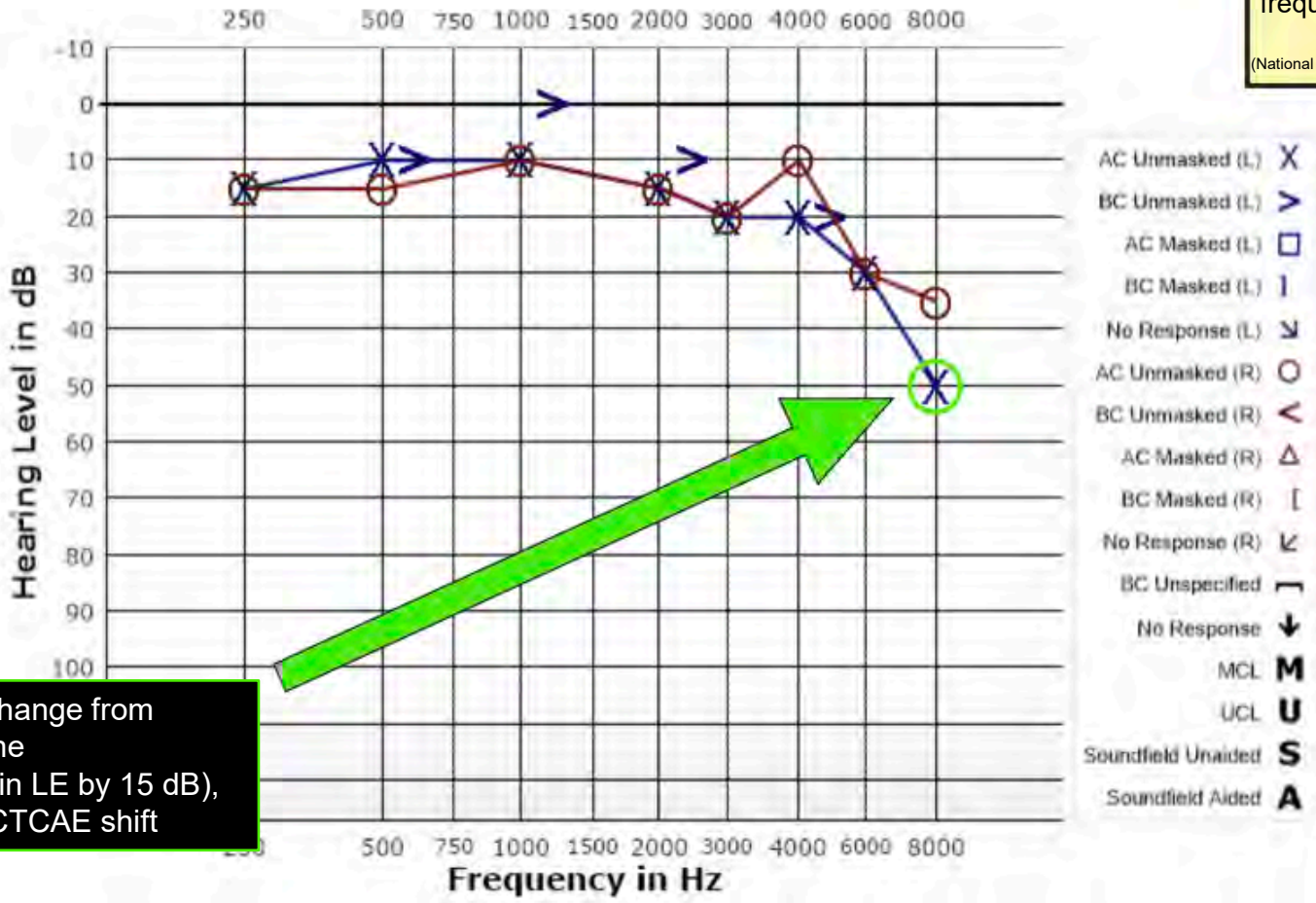
Visit 2 Results

Common Terminology for Adverse Events (CTCAE)

Grade 1 (mild) Shift:

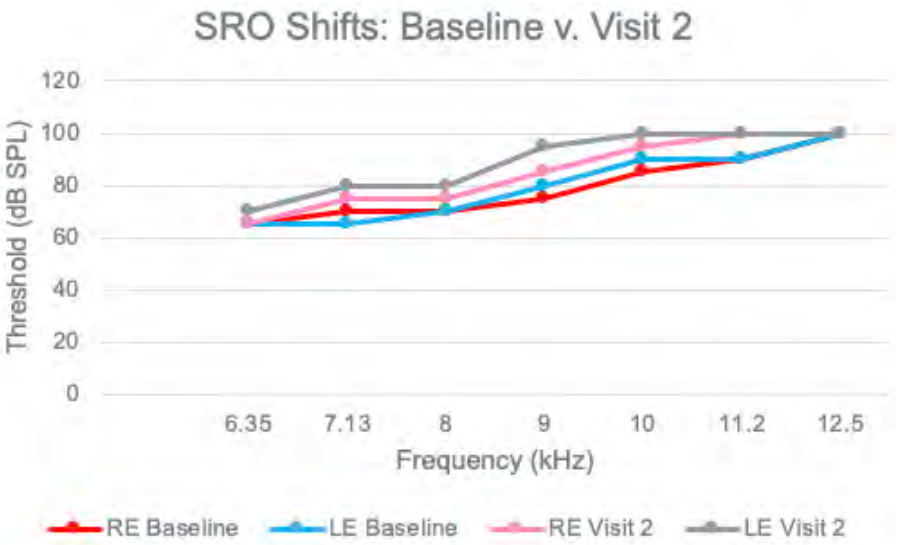
Threshold shift of 15 - 25 dB averaged at 2 contiguous test frequencies in at least one ear

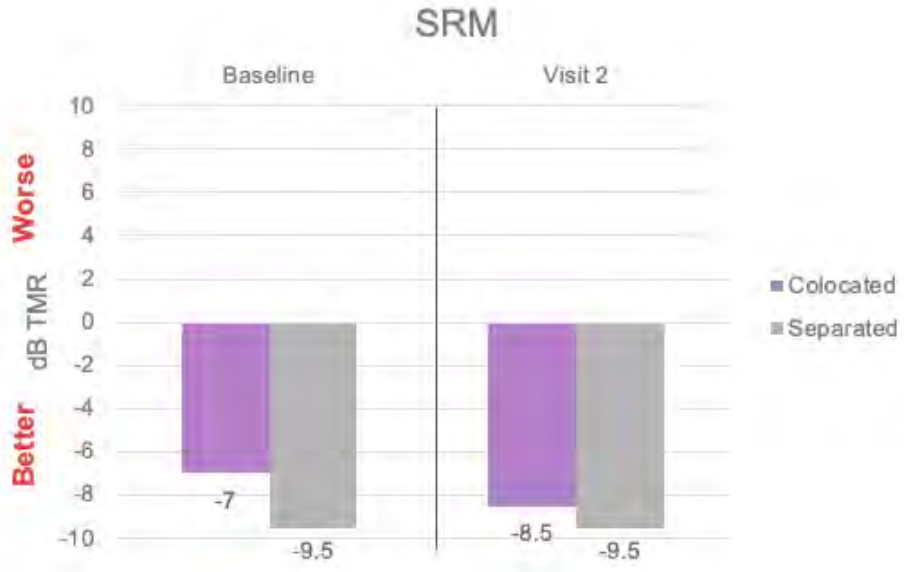
(National Institute of Health, 2017, p. 12)



Only change from baseline
(8kHz in LE by 15 dB), not a CTCAE shift

Visit 2 Results



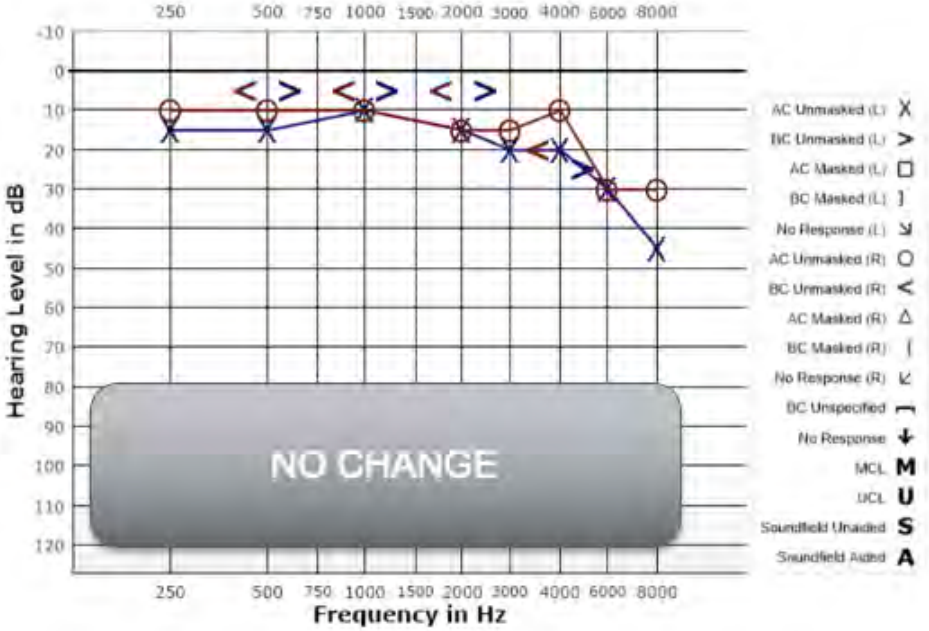


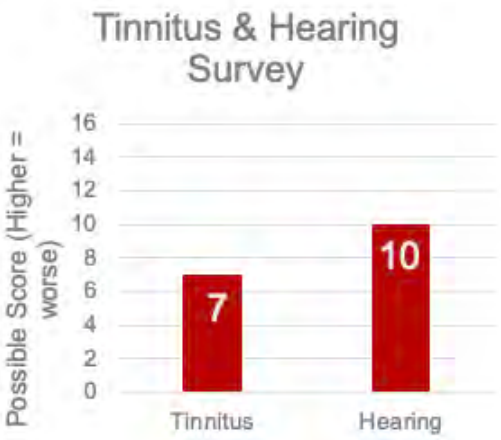
Visit 3

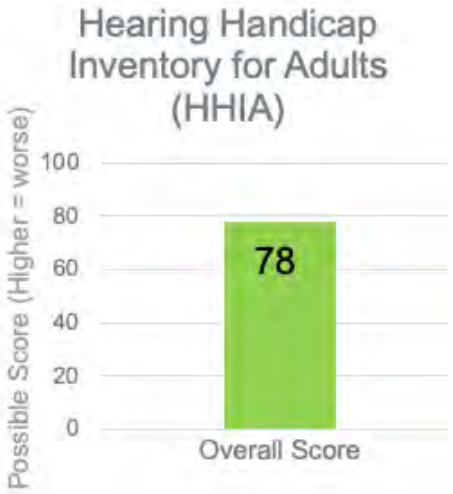
- 5 months after baseline
- Cisplatin regimen completed
- New subjective reports:

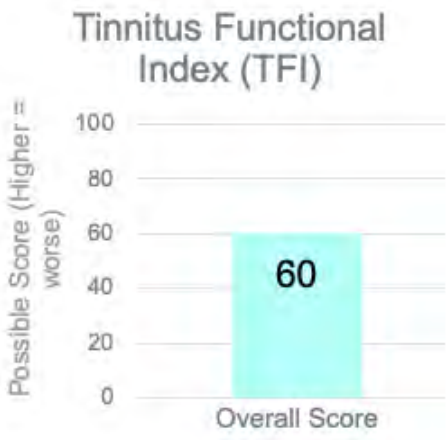
Bothersome Tinnitus	• Impacts sleep, relaxation, concertation • Difficulty ignoring and coping
Gradual Hearing Loss	• Fluctuates • Most noticeable in noise • Interferes with daily life • Social withdraw
Dizziness	• 1st noticed ~ 6 weeks ago • Head movements trigger • Impacts daily life

Visit 3 Results









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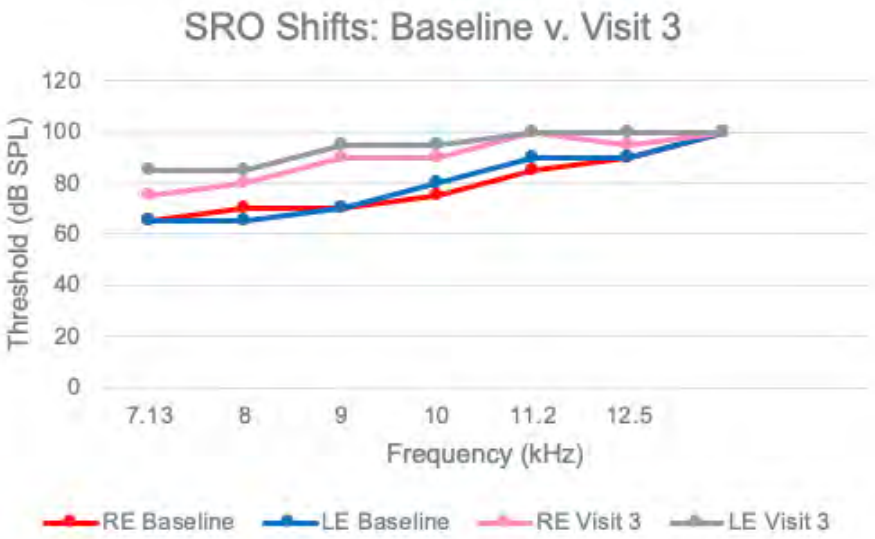
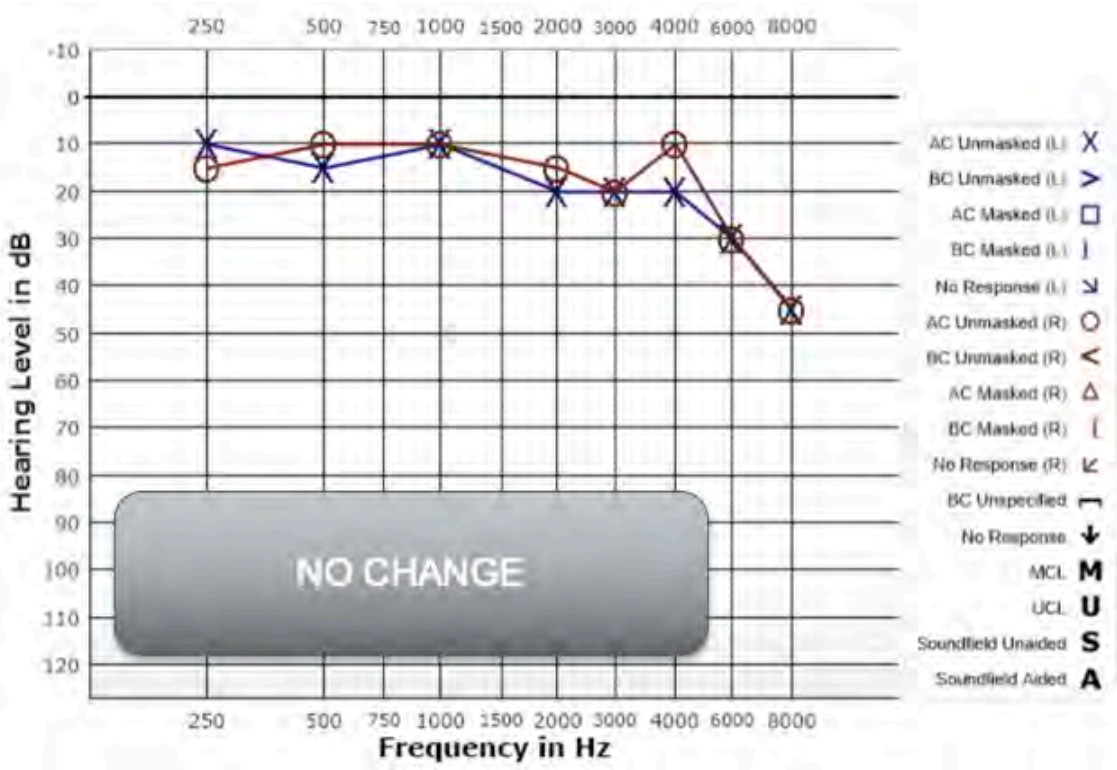


Phone Call Survey

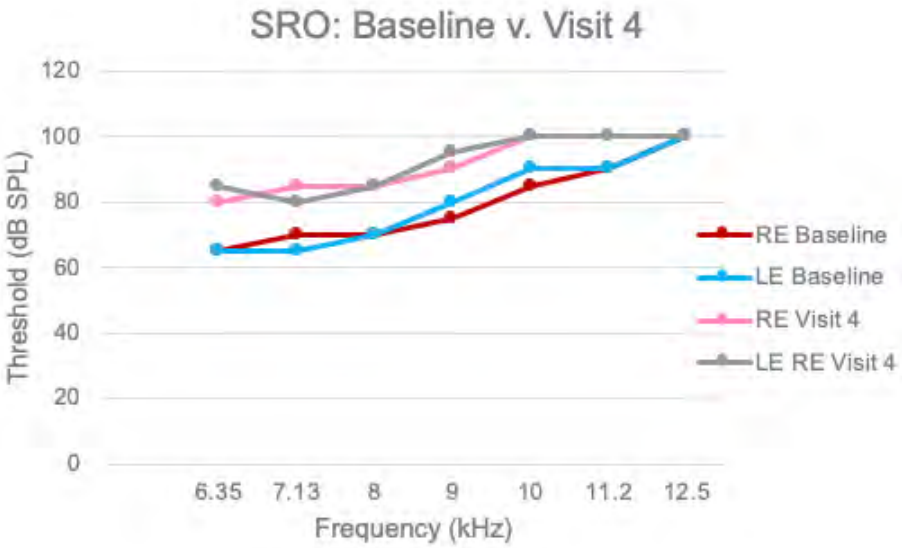
- 6 months after baseline
- Reports that the tinnitus is still bothersome
  - More frequently occurring
  - Less intense than initially
- Continues to impact quality of life

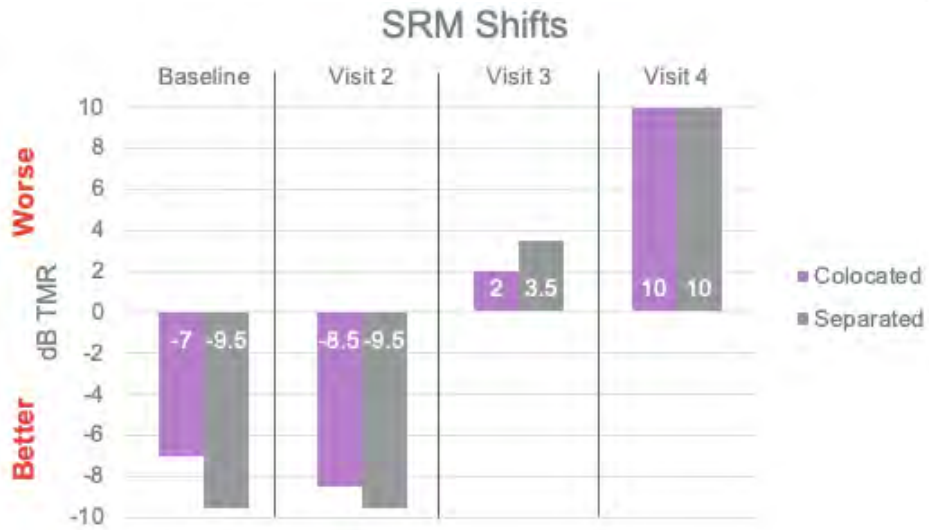
Visit 4

- 8 months after baseline
  - Increased tinnitus in LE



Visit 4 Results





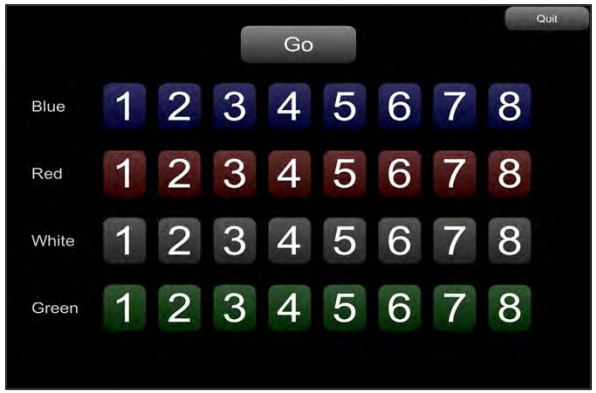
Best possible score: - 10 dB TMR
Worst possible score: 10 dB TMR

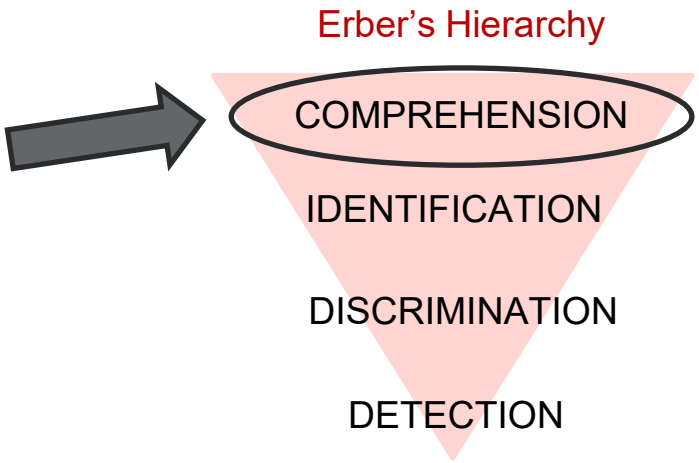
Takeaways

- Speech-in-noise and subjective measures should be included in monitoring appointments to avoid potential risk of missing ototoxicity
- SRM and SRO are quick and easy measures than can aid in early identification
- Baseline information is valuable
- Importance of continued monitoring after cisplatin treatment ends

Spatial Release from Masking (SRM)

- **Benefits**:
  - Quick
  - Easy for patients
  - Can be done on an iPad
    - Gamified
  - Self-administered
  - Easily interpretable results
  - Checks for comprehension





Sensitive Range for Ototoxicity (SRO)

- Similar procedure to conducting conventional audiometry
- Can be run on an extended high frequency
- Can be self or clinician administered
  - Bedside screening that can be paired with other measures
- Quick

Acknowledgements

This presentation was supported in part by VA RR&D grants I01 RX003127 and I50 RX002361 and an NIH T35 grant to NCRAR.

Thank you to:

Dr. Dawn Konrad-Martin, Ph.D.

Dr. Riley DeBacker, Au.D., Ph.D.

Dr. Michelle Hungerford, Au.D.

Dr. Hunter Stuehm, Au.D.

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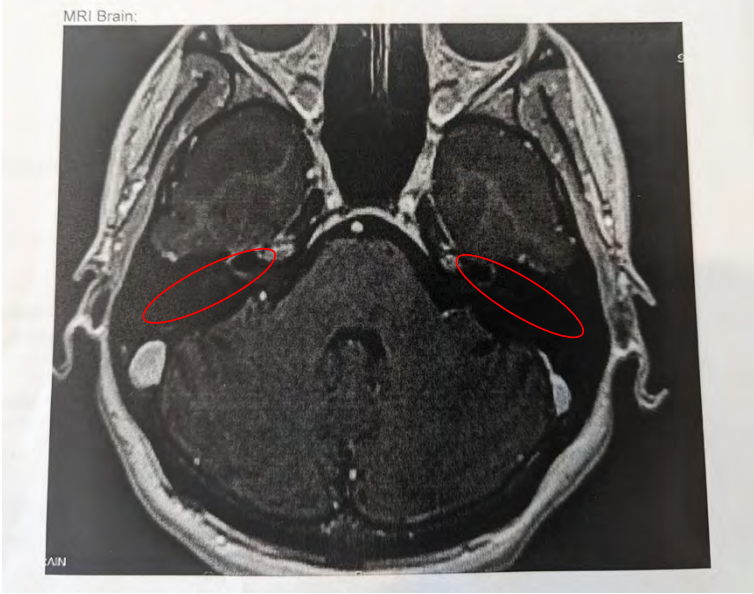
A Possible Case of Persistent Postural-Perceptual Dizziness

By Hailey Long

Patient: Ms. K

- 34-year-old Female
- Presented to Otoneurology 11/10/2022
- Primary complaint is dizziness
  - Dizziness has been daily since September/August
  - Worsens in the car, head movement, elevators, turning curves
  - Spells last one to several minutes
- Nystagmus looking to the left
- Daily pressure headaches
- Numbness of face, hand and feet
  - Worse on right side
- Right eye twitch
- Denies: double vision, blurry vision, facial weakness, difficult speech and difficulty swallowing

Ms. K's Case History



- Experienced her first headache in 2011
  - Accompanied by right eye twitch
  - MRI: normal
  - Prescribed Topamax, didn't like the side effects
- Miscarriage in August of 2011
  - Headache, numbness, and dizziness experienced daily
  - Patient suspected hormone changes
- Emergency room visit two days prior to visit with Otoneurology
  - CT of head normal
  - Neurology visit on 11/2/22
- MRI and MRV ordered
  - No full read on MRI at time of appointment with Otoneurology
  - Otoneurologist observed facial nerve enhancing bilaterally

Persistent Postural-Perceptual Dizziness

- Feelings of unsteadiness/dizziness that are triggered or exacerbated by visual and physical stimuli (Staab et al., 2017)
- Pathophysiology not fully understood
- Hypothesis: Neural pathway in the brain that is created when a vestibular incident along with certain visual stimuli, and feelings of stress/anxiety occur at the same time, thus causing a maladaptation that then resurfaces when exposed to those triggers (visual) causing feelings of dizziness or imbalance (Castro et al., 2022).

Diagnostic Criteria for 3PD

- "Feelings of dizziness, unsteadiness, or non-spinning vertigo that occur frequently for three months or more.
- Persistent symptoms occur without specific provocation, but are exacerbated by three factors including upright posture, active or passive motion, and exposure to moving visual stimuli or complex visual patterns.
- The disorder is precipitated by conditions that cause vertigo, unsteadiness, dizziness, or problems with balance including acute, episodic or chronic vestibular syndromes, other neurologic or medical illnesses, or psychological distress.
- Symptoms cause significant distress or functional impairment.
- Symptoms are not better accounted for by another disease or disorder."

(Staab et al. 2017, p 195)

Is 3PD an appropriate diagnosis for Ms. K?

What about Vestibular Migraine?

Differential Diagnosis: VM or 3PD

- Research conducted by Sarna et al. (2021) examined the overlap of patients in their neurotology clinic who met the criteria for VM and the criteria for 3PD
  - Questionnaires administered asking about the patients symptoms
  - 3PD was identified using diagnostic criteria established by the International Classification of Vestibular Disorders (ICVD)
  - VM was identified using diagnostic criteria based on the International Classification of Headache Disorders (ICHD)
  - 36 participants were diagnosed with PPD
- Results
  - Prevalence of migraine headaches in 3PD population was 53%
  - Of the entire cohort 72% were female
- Conclusion
  - There is a significant overlap of patients diagnosed with 3PD who also experience vestibular migraines
  - Hypothesized that migraines cause 3PD symptoms to be increasingly worse and last longer

(Sarna et al., 2021)

What does this mean for Ms. K?

- Ms. K currently meeting the diagnostic criteria for 3PD
- One of her primary complaints is daily pressure headaches
- Applying the research by Sarna et al. (2021) when considering treatment options for Ms. K
  - Treatment for VM
  - Treatment for 3PD
- Selective Serotonin Reuptake Inhibitors (SSRIs)
- Vestibular Rehabilitation
- Multimodal approach

Selective Serotonin Reuptake Inhibitors (SSRIs)

- Study by Min et al. (2021) based out of south Korea
- 197 individuals were diagnosed with 3PD and prescribed SSRIs
- Rate their dizziness by filling out the Dizziness Handicap Inventory (DHI)
- Clinician rated the severity of impact of 3PD using the Clinical Global Impression-Severity (CGI-S)
- Results
  - Noticeable improvement on the DHI and CGI-S was impacted by sex and age
  - Females had better outcomes than males
  - Younger individuals had better outcomes than older
  - Individuals who higher (poorer) CGI-S scores responded better to SSRIs
- Application to Ms. K
  - As a young female she falls into the demographic that had the best outcomes with SSRIs
  - Historically, Ms. K did not like pharmaceutical treatment

Vestibular Rehabilitation

- Study conducted by Eldoen et al. (2021) examined the effectiveness of VR on patients with 3PD
- Participants were provided with 6 weeks of online VR
  - Daily exercises
  - Provided a before and after of their symptoms via the Vertigo Symptom Score (VSS)
  - After VR the average VSS dropped by 6.9 points
- Web based VR was deemed accessible, easily understandable and effective
- Application to Ms. K
  - VR may be a treatment option that does not rely on pharmaceuticals and is still effective

Multimodal Treatment

- VR and SSRIs provide benefit to patients with 3PD in their own way
- When used together a synergistic effect that helps improve quality of life (Axer et al. 2020)
- Application to Ms. K
- SSRIs at a low dose may be beneficial to Ms. K
- VR can be used to supplement the SRRIs
- A multimodal approach may be best practice for treating 3PD

Takeaways

- Look at patient symptoms and case history diligently
  - Without knowing Ms. K's description of her dizziness and her medical/emotional history may have been stuck
- Acquire as much knowledge as you can about disorders that have recently been defined
- Consider a dual diagnosis when appropriate
- Consider all treatment options when making a plan of action

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Considerations in audiologic intervention for adolescents

Theodora Bowman, BHS, BS

4th year AuD student

The Ohio State University

Presentation outline

Introduction of case

In depth case history

Audiologic test results

Treatment recommendations

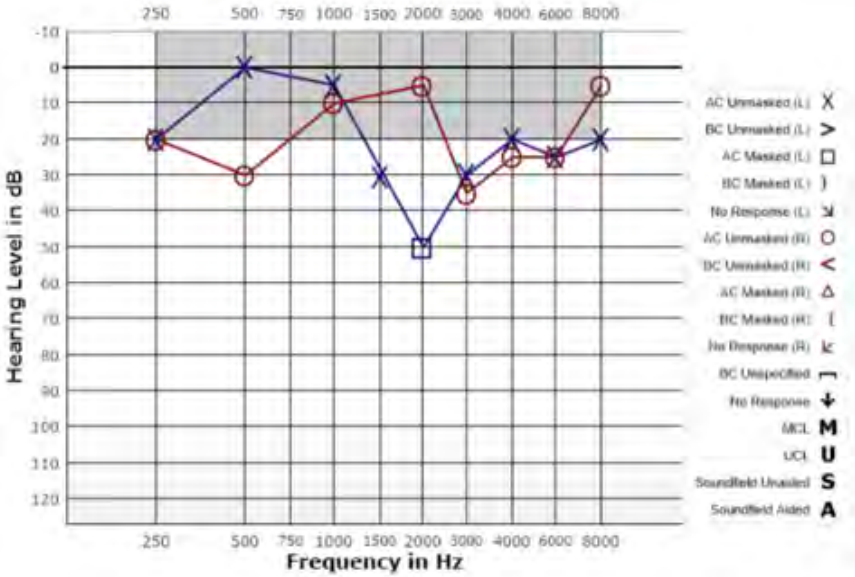
Outcomes over time

Relationship between hearing loss & mental health and supporting literature

Conclusion and key takeaways

Introduction to "AN"

- AN is a 16-year-old female
- Has had a stable SNHL for 10 years
- *"Bilateral SNHL with interweaving asymmetries and areas of normal hearing"*



CONFIGURATION	
Audiometer	GSI-AudioStar Pro
Calibration	12/10/2020
Reliability	Excellent
Test Method	Conventional
Transducer	High Frequency Headphones

PTA (.5, 1, 2kHz)	
Right	Left
15	18.33

Neg: No significant reflex decay **Pos:** Significant reflex decay **Abs:** Absent **Pres:** Present **WNL:** Within Normal Limits **Red:** Reduced
NR: No Response **CNS:** Could Not Seal **CNT/DNT:** Could/Did Not Test **WR:** Word Recognition **SF:** Soundfield **EP:** Earphones

WORD RECOGNITION (Presentation: Recorded / Word List: NU-6)						
	dBHL	%	Mask	dBHL	%	Mask
Right	60	88				
Left	60	80				

SPEECH AUDIOMETRY (Word List: Spondees)					
	SAT	SRT	Mask	MCL	UCL
Right		20			
Left		20			

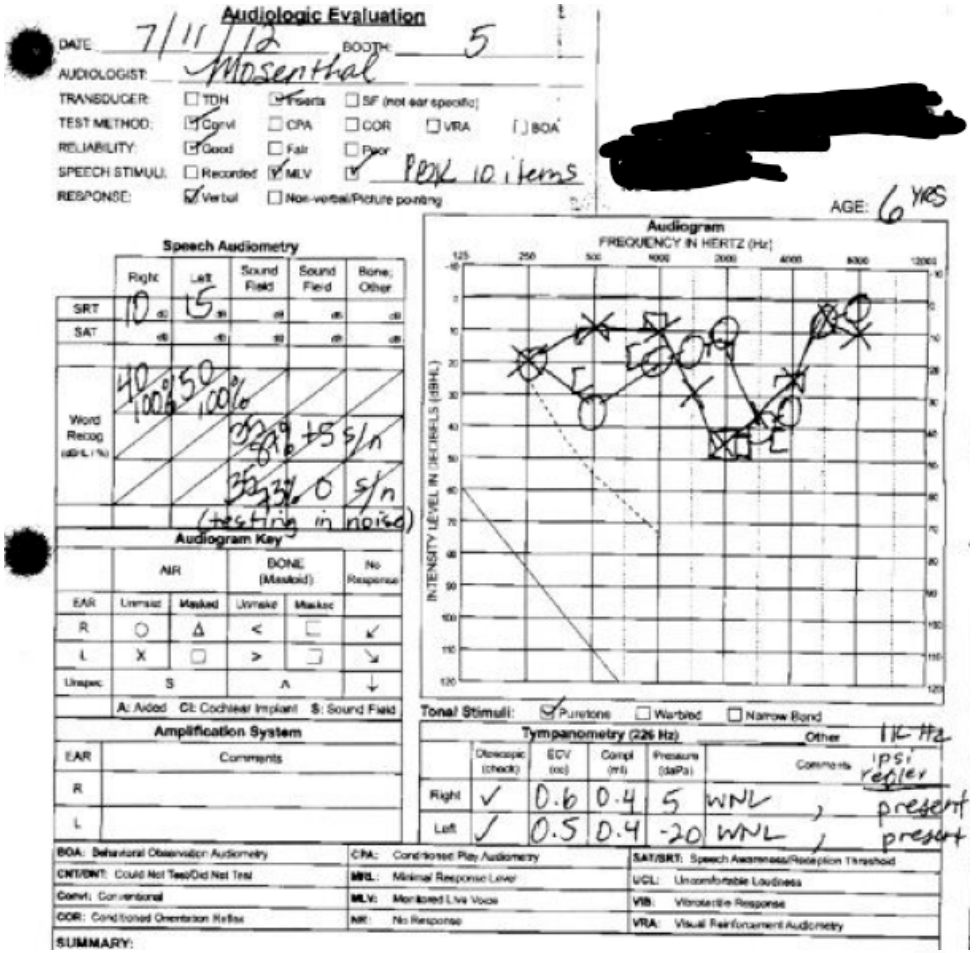
Initial diagnosis

- Diagnosed with bilateral SNHL at age 6
- Failed hearing screen at pediatrician
  - No concern of speech/language/hearing
  - No history of MEIs
  - Referred to get full evaluation to r/o hearing loss

Initial evaluation results: July 2012

"Hearing within normal limits save for a mild/moderate mid frequency notched sensorineural hearing loss left for 1.5-4 kHz, and also for the right but with a mild notched sensorineural hearing loss at 500 Hz and a mild bordering moderate notched sensorineural hearing loss at 3-4 kHz."

100% word recognition in quiet AU
87% word recognition in noise (+5 dB SNR)
73% word recognition in noise (0 dB SNR)



Recommendations

“Mild” hearing loss explained

- Educationally and communicatively significant
- Presence vs. access to speech

Otolaryngology consultation

- New ID of SNHL
- CT scan

Genetic testing & sibling hearing evaluation

Trial amplification if medically cleared

Monitor hearing at 3–4-month intervals over next year

Treatment timeline: Elementary & Middle school

- November 2012: **First fit with BTE** hearing aids (1st grade):
  - Acclimatization & consistent use
  - Listening accommodations & FM system trial
  - Academic improvement
- August 2013 – 2016 (2nd – 4th grade):
  - Implementation of 504 plan
  - FM system utilized
  - Consistent use
- September 2016 – June 2020 (5th grade – 8th grade):
  - New hearing aids (RICs)
  - Beginning to express not wanting to wear hearing aids
  - Doesn't like being "different"
  - Importance of consistent hearing aid use discussed

Thresholds over time = stable

High school years: August 2020 - Present

- New hearing aids
  - Lost multiple times
  - Independence with hearing aids & DM system
- Not wearing hearing aids
  - Grades slipping
  - Struggling in noisy situations
    - R-SPIN: aided vs. unaided
- Discussion (again): Importance of consistent use
  - Ability for HAs to help in noise
  - Academics
  - Listening effort

+4 unaided
67%
LP = ~~50%~~
HP = 92%

LP = 100%
HP = 100%

Aided @ +4 SNR
~~and~~

Mental health concerns: October 2022

- Academics & relationships suffering
  - Doesn't want to use HAs to help
- Hearing loss thought to be factor
  - *"The interplay of her hearing loss and feelings of anxiety seem to lead to a complete spiral"*
  - *"She's a hurting teen at the moment"*
  - *"I'm just not sure where to start addressing her mental health"*

Impact of hearing loss on pediatric mental health

- Mental health problems are now surpassing physical health problems in children and adolescents.[10]
  - Mental health disorders affect about **1 in 5 children.** [4]
- **Children and adolescents with hearing loss are at higher risk for mental health disorders.**[3,4,6,8,13,15]
  - **15.4-31.3%** of participants with HL had a lifetime prevalence of anxiety compared to 9.4% in typical-hearing peers. [4]
  - **26.3%** of participants with HL had a lifetime prevalence of depression compared to 3.4% of typical hearing peers. [4]
  - **32.6%** of participants with HL had a current mental health diagnosis and **45.4%** had a lifetime diagnosis [6] – **unrelated to degree of hearing loss**
- Although there are effective treatment methods for hearing loss, a child's quality of life can still be affected socially, emotionally, and behaviorally.
- The concern of poor mental health in pediatric hearing loss patients has grown due to the impacts seen on social-emotional development. [9,12,13,17,18]

"Prevalence of Depression and Anxiety in Adolescents with Hearing Loss" – *Cejas et al. (2020)*

Purpose:	Why?	How?

• To develop and implement a screening protocol for depression and anxiety for adolescent patients in otologic/audiologic care
• Estimate overall prevalence & within degree of HL
	• Children & adolescents are at ↑ risk for mental health problems
	  • Lack of research
	• Academy of Pediatrics & American Academy of Audiology recommendations
	  • Universal screening protocols: not adopted
		• GAD-7 (anxiety) and PHQ-8 (depression) screeners completed by 92 adolescents in annual visit

“Prevalence of Depression and Anxiety in Adolescents with Hearing Loss”

– Cejas et al. (2020)

Results

- 25% of adolescents scored above clinical cutoff on ≥ 1 screener
- 30% at risk for depression; 21% at risk for anxiety
- **Suggests adolescents with hearing loss are at ↑ risk for depression/anxiety**
- Significant correlation: PHQ-8 scores & age
- Type of HL: majority bilateral SNHL
- Degree of HL: majority severe to profound
- Type of hearing device: no sig. differences

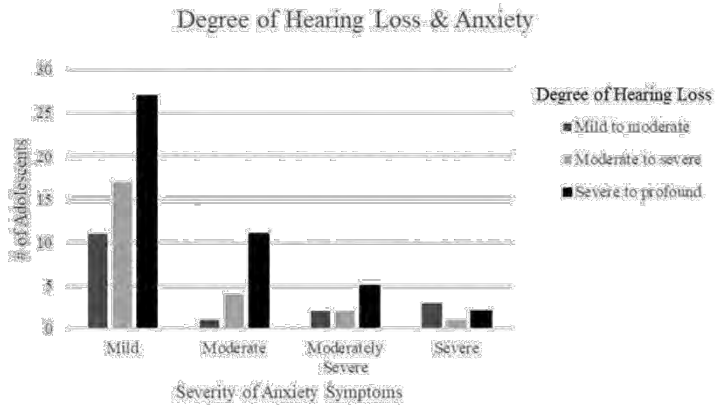


FIG. 2. Adolescent scores on GAD-7 by degree of hearing loss. *Note.* Adolescents classified as moderately severe or severe for anxiety are within the clinically elevated range of concern. Adolescents considered “at-risk” are classified as moderate and those classified as mild are considered to experience normal levels of anxiety. GAD indicates generalized anxiety disorder.

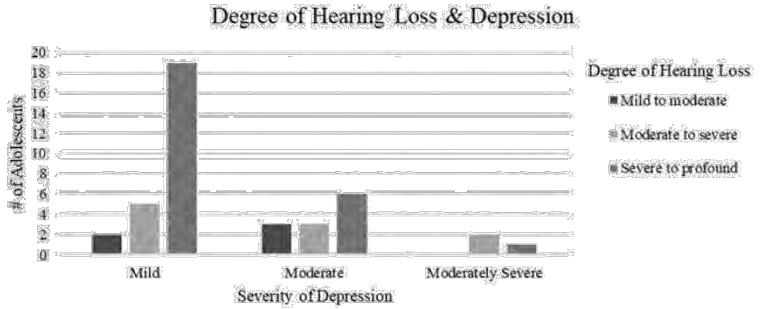


FIG. 1. Adolescent scores on PHQ-8 by degree of hearing loss. *Note.* Adolescents classified as moderate for depression are within the clinically elevated range of concern and adolescents considered “at-risk” are classified as mild. PHQ indicates Patient Health Questionnaire.

"Prevalence of Depression and Anxiety in Adolescents with Hearing Loss"

– Cejas et al. (2020)

Relation to the case:

- "AN" and her mother have concerns re: anxiety and depression
- Use of mental health screener
  - Easy to implement
  - Contribution to early identification/intervention
  - **In the audiologist's scope of practice!**
    - The American Speech Language and Hearing Assocation (ASHA) Scope of Practice for audiologists includes the use of screening measures of mental health to assist with detecting, treating, or referring for mental health concerns.
- Need good rapport with local mental health professionals
  - Interdisciplinary care
- HL + Mental health = complex relationship
- What else can the audiologist do besides screen and refer for mental health concerns?
  - The audiologist's scope includes both informational and personal adjustment counseling

"Counseling Adolescents with Hearing Loss with the Use of Self-Assessment/Significant Other Questionnaires" – *Elkayam & English (2003)*

- Purpose:
  - To adapt an adult self-assessment questionnaire for adolescent use to help facilitate counseling
    - Why SAC/SOAC?
- Why?
  - Counseling can and should be provided by audiologists
    - Especially important for adolescents
      - But it can be daunting!
  - Most questionnaires are designed for adults or children
- How?
  1. 20 adolescents with bilateral HL were given the adapted questionnaire (SAC-A)
  2. Friends given adapted SO questionnaire (SOAC-A)
  3. Responses discussed with investigator
  4. Informational and personal adjustment counseling was guided by responses
  5. Follow-up questionnaire given to determine benefit

"Counseling Adolescents with Hearing Loss with the Use of Self-Assessment/Significant Other Questionnaires" – *Elkayam & English (2003)*

Results

- Common themes re: counseling sessions
  - The inherent isolation of hearing loss
  - Identity and self-concept
  - Cosmetics and other hearing aid issues
  - Problem solving
  - Self acceptance
- Follow-up questionnaire
  - 80% ranked themselves a 4 or 5/5 on ≥ 1 question
  - 10 ranked themselves a 4 or 5/5 on ≥ 2 questions
  - 8/15 stated that it was helpful to talk about their hearing loss

Table 5 Average (Mean) Responses and Range of Responses for Each Statement

Questions:	Mean	Range
1. I learned new information about my hearing loss.	3.53	1–5
2. I have changed, or will think about changing, my behavior with respect to my hearing loss.	2.73	1–5
3. I feel differently about myself as a person with a hearing loss.	2.53	1–5
4. Talking about my hearing loss has been helpful.	3.4	1–5
5. I would like to have more opportunities to talk about my hearing loss.	2.8	1–5

"Counseling Adolescents with Hearing Loss with the Use of Self-Assessment/Significant Other Questionnaires" – *Elkayam & English (2003)*

Relation to the Case

- Common feeling: *being negatively judged by others when wearing hearing aids or because of communication difficulties*
  - "Hearing aid effect"
- AN's inconsistent use
  - Social/emotional cost not worth the communicative benefit
  - Communication issues: *fruitless*
  - Informational counseling ≠ successful rehabilitation
    - *"Discussed importance of regular use"*

Next steps for “AN””

Now:

- Ohio Parent Mentor Program
- Potentially changing schools for more support
  - Very independent
- Hearing aid use

Future:

- More support
- Self-advocacy skills
- Mental health evaluation
- Counseling
- Improve audiologic intervention

Key points & final thoughts

- **Mental health disorders are more prevalent in children & adolescents with hearing loss**
- **Think further than just emphasizing importance of consistent hearing aid use**
  - More complexities involved
- **Regardless of the severity of hearing loss, pediatric patients should be screened for mental health disorders** to support early intervention, treatment adherence, and improvement in quality of life
  - Mild hearing loss ≠ mild impact
- **More training for audiologists** is needed regarding mental health education, common psychological disorders related to hearing loss, and use of mental health screeners
  - We have a role in our patients' mental health!
- **Rapport with mental health professionals is important**
- **Counseling**
  - Audiologists *can* and *should* provide counseling
    - Informational counseling ≠ successful rehabilitation
  - Adolescents need support!
  - Need training on how to have discussions re: mental health

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A Broader Perspective of Ototoxicity

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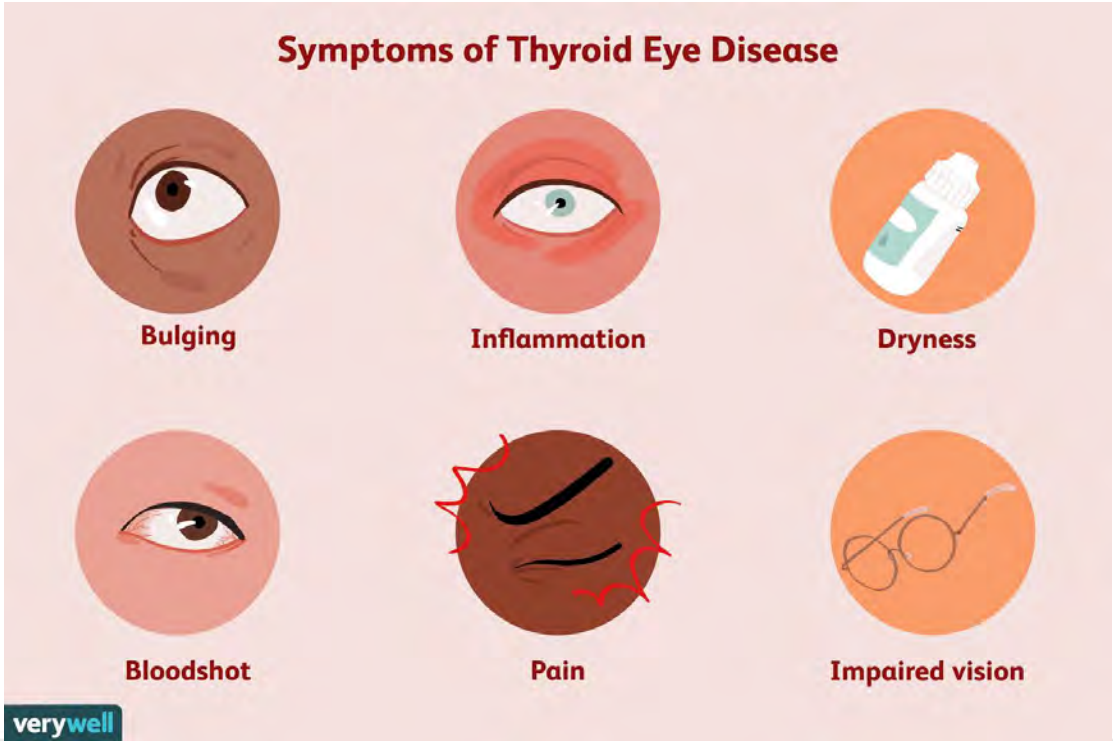
Thyroid eye disease (TED)

- A condition where the immune system mistakenly attacks the muscle and fat tissue behind eyes, causing inflammation (redness and swelling) and scar tissue to form (from: https://www.thyroideyes.com)



Thyroid eye disease (TED)

- Risk factors have been identified in the development of TED including genetics and family history, gender (women are at a higher risk than men), cigarette smoking, and treatment with radioactive iodine
- TED is a rare disease, which had an incidence rate of approximately 19 in 100,000 people per year
- Symptoms include: eye bulging, double vision, strabismus (eyes don't coordinate or are misaligned), eye pain, redness, and swelling

Tepezza

- Used to treat thyroid eye disease (TED)
- An infusion treatment, with typical side effects of infusion treatments; each treatment is thousands of dollars
- Reduces/improves the symptoms of thyroid eye disease, which can include
- Heavily advertised on television and in social media

Tepezza: How does this apply to patients who may see an audiologist?

- Ototoxicity:
  - Research reports indicated that between 10-65% of patients treated with Tepezza reported hearing loss, which appeared to be permanent sensorineural hearing loss
  - Tinnitus is a currently reported side effect, with or without hearing loss
  - There is currently a class action lawsuit against Horizon Therapeutics USA Inc., manufacturer of Tepezza. The lawsuit alleges that the company failed to warn about potential hearing loss and tinnitus caused by this drug

Tepezza: How does this apply to patients who may see an audiologist?

- Raises questions for us:
  - Audiologists should be part of an interprofessional practice team (IPP) for patients with potential ototoxic treatment, beyond what we might think of as the usual aspects (e.g. a patient receiving chemotherapy for cancer)
  - Educating physicians that treatment side effects related to hearing/tinnitus/balance should be presented to patients PRIOR to treatment
  - Pre-treatment audiologic assessment is indicated
  - Reporting perceived hearing loss/tinnitus to the treating physician and doing so immediately
    - Physician taking this information “seriously”

Case: GN

- 53 year old patient who is an optometrist
- Had waited more than a year to have insurance approve his infusion of Tepezza and reported that this appears to be related to the cost, which he mentioned was about $12,000 per infusion
- Prior to the first infusion, risks and side effects were mentioned but at no point in time was he told about the potential of hearing loss and/or tinnitus as possible side effects
- Dr. N. had a positive family history of tinnitus, as his father developed what was described as significant tinnitus when he was a relatively young man

Case: GN

- Dr. N. had an audiologic evaluation several years ago as a routine procedure at an ENT appointment when he had persistent mastoid pain that was found to be related to muscle spasms in his neck and it resolved when treated with medication and massage.
  - Results were consistent with normal peripheral hearing acuity bilaterally
- Five to seven days after his first infusion with Tepezza, Dr. N. reported that he had a constant bilateral tinnitus that he described as “ringing” and reported aural fullness
- He then looked at side effects and found that common side effects of treatment with Tepezza were hearing loss and tinnitus

Case: GN

- Dr. N contacted this clinic about 3 weeks following the infusion (2 weeks after the tinnitus started) for an audiologic evaluation
  - The Tinnitus Handicapped Inventory (THI) was administered and his responses placed him in the mild category of tinnitus disturbance
  - He reported concerns about the tinnitus based on his experience with his father's tinnitus
  - He continued to report aural fullness
  - His goal for this appointment was to obtain a "baseline" for hearing and tinnitus (although he recognized this would have been best done prior to his first infusion)

Case: GN results

- An audiological evaluation in March, 2023 revealed normal hearing acuity bilaterally, with pure tone averages of 7 dB HL for the right ear and 3 dB HL for the left ear
- Extended high frequencies through 12,500 Hz revealed a mild hearing loss bilaterally
- SRT 5 and10 dB HL for the right and left ears, respectively, with word recognition of 96% for the right ear and 100% for the left ear
- Word recognition in noise was a .5 SNR loss, consistent with normal performance
- Tinnitus pitch match was 4000 Hz and tinnitus loudness match was 16 dB SL

Based on the results of this evaluation and presence of tinnitus:

- Dr. N. opted to discontinue the Tepezza treatment (generally a total of 3-4 infusions)
- Talked with his ophthalmologist about letting patients know about obtaining a baseline audiologic evaluation prior to starting treatment and to encourage patients to contact their physician immediately if they have a perception of decreased hearing and/or tinnitus
- His ophthalmologist reportedly was not particularly concerned and indicated the ringing would ”just go away”

Take aways

- Update…the tinnitus has not ”gone away”. Persistent, now chronic, tinnitus
  - Dr. N. has learned to minimize his perception of tinnitus and his THI is 10
  - He is advocating for audiologic assessment prior to initiating Tepezza treatment
  - Class action lawsuit related to Tepezza treatment
    - Audiology’s role in interprofessional practice in patient care
    - Broader view of ototoxicity

Thank You!

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