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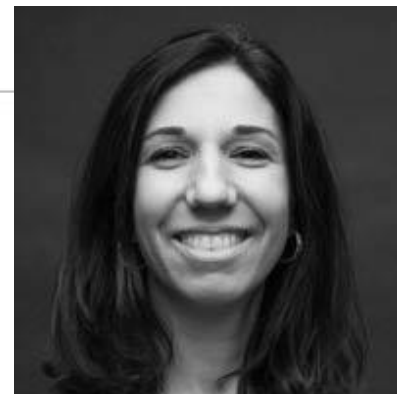
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FROM CLINIC TO CLASSROOM

Functional Approaches to Working with Children with Unilateral Hearing Loss: Part 1, in Partnership with the Educational Audiology Association

Kristin Dilaj, AuD/PhD, CCC-A



Kristin Dilaj, PhD, AuD, CCC-A

Dr. Kristin Dilaj is Co-Director and Audiologist at the New England Center for Hearing Rehabilitation, LLC. Her areas of clinical interest and research include evaluating functional listening skills for children, access recommendations for students in educational settings, cochlear implant programming strategies and outcomes, and pediatric aural (re)habilitation. She is a state representative for the Educational Audiology Association, a past president of the Academy of Rehabilitative Audiology and a co-chair of the Connecticut EHDI Task Force.

Disclosures

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Learning Outcomes

After this course, participants will be able to:

- Discuss the challenges children face with unilateral hearing loss.
- Discuss current types of device recommendations for pediatric patients with unilateral hearing loss.
- Explain how to utilize functional measures which promote individualized recommendations for personal and educational devices.

Unilateral Hearing Loss

Common Recommendations

Template Recommendations

Scooby presented with a moderately-severe hearing loss in his right ear and normal hearing in the left ear. Due to the unilateral hearing loss, Scooby will have difficulty hearing in noisy environments at school and localizing. The following is recommended:

- Scooby should receive preferential seating in school.
- Scooby should use an FM/DM system in school.

Potential School Take-Aways

- No hearing aid? No Problem!
- Child has normal hearing in one ear, No Problem!
- Set Scooby up front and center. This provides great access!
- A remote microphone system (RMS) in the ear with hearing loss will help this child.

Unilateral Hearing Loss

A Quick Review

Unilateral Hearing Loss (UHL)

- Hearing Loss in One Ear
 - Avg PTA greater than or equal to 20 dB HL
- Normal Hearing in the Opposite Ear
 - Avg PTA at or better than 15 dB HL in the “better hearing ear.”

Etiology

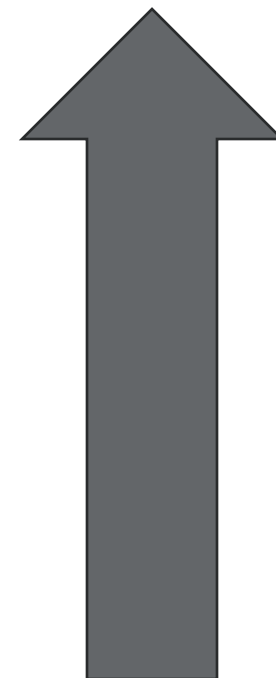
- Unknown for 30-55% of Cases
- Congenital Causes & Acquired Causes
 - Cytomeglovirus (CMV)
 - Meningitis
 - Enlarged Vestibular Aquaduct (EVA)
 - Atresia
 - Genetic
 - Prematurity
 - Cochlear Nerve Deficiency (CND)
 - Ototoxicity
 - Head Trauma
 - Craniofacial Anomalies

UHL

- Unilateral Conductive Hearing Loss (UCHL)
 - Middle Ear Effusion, Atresia, Craniofacial Anomalies
- Unilateral Sensorineural Hearing Loss (USNHL)
 - CMV, EVA, ANSD, CND
- Single-Sided Deafness
 - One ear is completely without hearing

Prevalence

- 0.6-0.7 per 1000 newborns have UHL
- 3%-6% of school-aged children
 - (Bess et al., 1998; Ross et al, 2010)
- Why such a BIG Change???



Two Ears Make a Difference

Binaural Hearing is Important for Access



Why Two Ears?

Binaural Summation

- Increased loudness perception
- Improved speech perception

Interaural Differences (Phase, Intensity, Timing)

- Localization
- Improved hearing in noise

Head Shadow

- Localization
- Improved hearing in noise

Release from Masking

- Localization
- Improved hearing in noise

Precedence Effect

- Localization

Ability to Communicate in
Dynamic Environments

Historical Perspectives....

- *“The conventional attitude concerning the effects of a unilateral hearing loss has been that it would have little impact upon a child’s academic performance.” (Oyler et al., 1988)*
- Normal hearing in one ear...they should be fine!
- Students with UHL should be able to go through school & learn like any child



Today's Classroom



Expectations in Today's Classroom

- Teacher Directed Learning
 - Co-Taught Classes
 - Para Support
 - Peer Directed Learning
 - Partner Learning
 - Small Group Learning
 - White Boards
 - Lab Groups
 - Independent Learning
 - “Google Classroom”
 - Social Situations
- 

Students with UHL

- Areas of Concern:
 - Speech perception (Bess et al., 1986; Ruscetta et al., 2005)
 - In Quiet
 - In Background Noise
 - Localization ability (Bess et al., 1986; Humes et al., 1980; Priwin et al., 2007)
 - Auditory fatigue (Adams et al., 2023; Bakkum et al., 2023; Sindhar et al., 2021)
- What does this IMPACT?

ACADEMIC & SOCIAL SUCCESS

What we know...

- Areas of Concern
 - Language Development (Borg, 2002; Lieu, 2004, 2010, 2012, 2013)
 - Social-Emotional (Bess et al., 1998; Ong et al., 2023)
 - Cortical Reorganization (Bilecen et al., 2000; Vasamara et al., 1995)

Common Parent & Teacher Concerns

- Inattentive
- Seemingly uninterested in classwork
- Poor behavior
- Not achieving to full potential

What we know...

- Academic Impact
 - Issues with failing/repeating grades (Bess & Tharpe, 1984, 1986)
 - Academic/behavioral concerns (Brookhouser et al, 1991; English & Church, 1999)
 - 59% of kiddos with UHL had academic or behavioral problems
 - 35% of children with UHL will fail at least one grade
 - Additional 15-60% will need additional resources in school
 - Need for IEPs (Lieu et al., 2010, Lieu, 2013)

Diagnosis of UHL



Audiologic Considerations

- Do you know the Etiology?
- Importance of Correct Masking
- What happens when you have a child where only sound field results were previously obtained?

Audiologic Considerations

- Goals of Evaluations
 - Does the child have usable hearing on that side?
 - Tones vs. Speech
 - How does the child hear in noise?
 - Functional Testing Suggestions to follow
 - What is the appropriate recommendation for NOW?
 - How do I counsel about the future??

Review of Device Options

“The purpose of providing amplification for children is to minimize the negative impacts of their hearing loss on communication development and academic achievement” (AAA, 2013)

Device Options

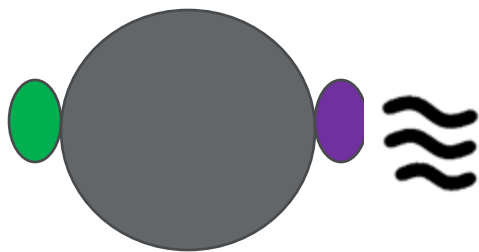
- Hearing Aid
- CROS Device
- Bone Conduction Devices
- Cochlear Implants
- Assistive Technology Options
- Access Supports

Case by Case Basis

Acoustic Devices

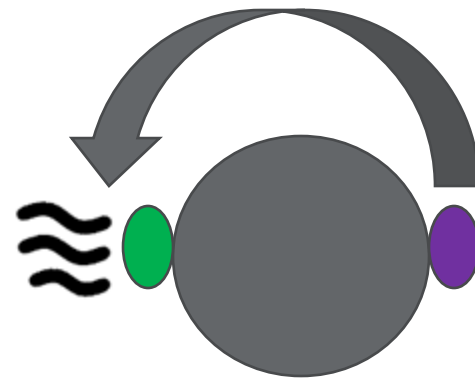
- Hearing Aid

- Has the potential to help with localization
- Has the potential to improve word recognition
- Stimulates the auditory nerve of the “poor” ear



- CROS

- Does not help with localization
- Does not give speech perception to “poor” ear
- Allows “access” to sound on the “poor” side

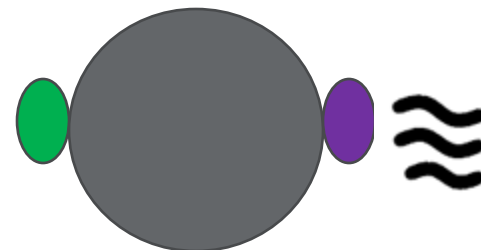


Bone Conduction Devices

- Depends on Etiology

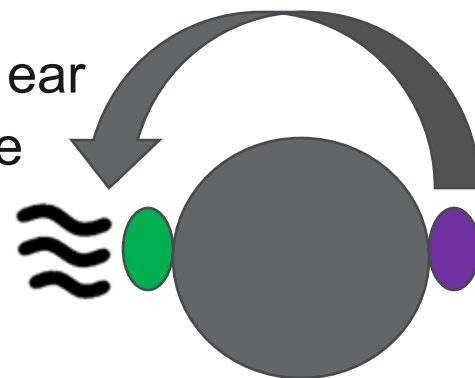
- UCHL

- Has the potential to help with localization
 - Has the potential to improve word recognition
 - Stimulates the auditory nerve of the “poor” ear



- USNHL/SSD

- Does not help with localization
 - Does not give speech perception to “poor” ear
 - Allows “access” to sound on the “poor” side

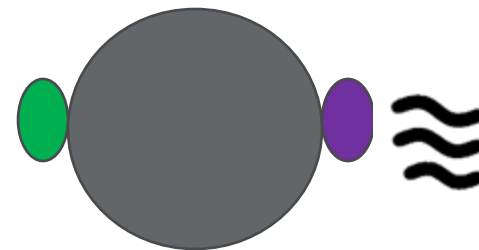


Bone Conduction Devices

- Softband/Sticker
 - Cochlear Americas BAHA
 - Med-El Adhear
 - Oticon Medical Ponto
- Surgical Options
 - Cochlear Americas BAHA (Age 5)
 - Cochlear Americas Osia 2 (Age 5)
 - Med-El Bonebridge (Age 12)
 - Oticon Medical Ponto (Age 5)
 - Oticon Medical Sentio (Age 12)

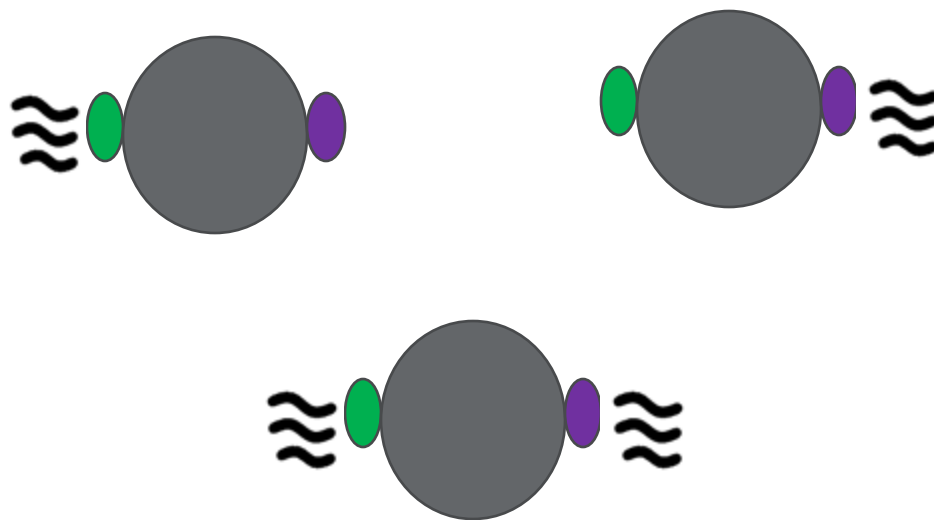
Cochlear Implant

- Has the potential to help with localization
- Has the potential to improve speech recognition in quiet & noise
- Stimulates the auditory nerve of the “poor” ear



Assistive Technology & Supports for Access

- FM/DM Technology
 - Sound Field
 - Personal Devices
 - Which ear(s)?
- Access Supports
 - Strategic Seating
 - Noise Reduction
 - Academic Supports
 - Visual Supports
 - Captioning



Gathering Data for Individualized Recommendations

Going beyond your audiogram & hearing evaluation

Why are YOU important?

- You are making all the recommendations for personal devices
 - This directly IMPACTS school options for assistive technology
- Your report is the **FIRST** and possibly **ONLY** presented to a district. It will be read by different team members:

Parents

SLP

TOD/TOHI

Administration

Psychologists

Administration

Nurse

Teachers

Device Recommendations

- Goal: Optimize the Student's FUNCTION
- Questions that YOU should be able to answer
 - What are the child's listening environments?
 - What is the child listening to?
 - What are the goals for the family?
 - Detection? Speech Perception?
 - What are the educational placement options?
 - Is there an educational audiologist to communicate with?
 - Will a personal device be beneficial for this child?
- To get Buy IN, you NEED DATA!

Personal Device Recommendations

- Do we work toward making the ear with UHL usable?
 - Use of hearing aid
 - Recommendation for cochlear implant
- Do we send the information to the “better ear”?
 - CROS devices
 - Bone conduction devices (band vs. surgical)
- Do we use assistive technology?
 - Personal FM/DM vs. Sound Field
 - Which ear provides the best benefit?
- Is NO device OK?

Additional Testing: Determining Functional Listening Abilities

- What is the child's performance with the device(s) you are recommending?
- How you evaluate and the test choices you make will look different based upon:
 - Child's Age
 - Child's Language Level
 - Co-Occurring Diagnoses

Determining Functional Listening Abilities

- Baseline Word Recognition
 - Aided Vs. Unaided
 - Open Vs. Closed-Set Tasks
 - Conversational vs. Soft
 - Close/Distance
 - Recorded vs. MLV
 - Toward “Good” ear (Direct) vs. Toward “Bad” ear (Indirect)

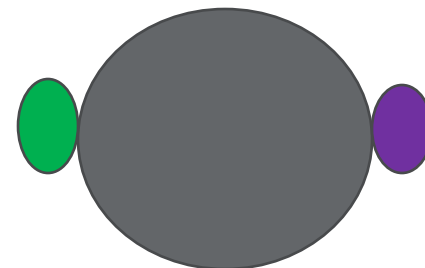
Testing in Noise

- “Measures that focus on speech in noise ability are recommended to assess the need for hearing assistive technologies (HAT) that enhance the signal-to-noise ratio.” (Bagatto et al., 2019)
- Test with different configurations
 - Trial different setups if possible
 - i.e. Soundfield vs. Focus
- May need to test at different SNRs

Determining Functional Listening Abilities

- Speech Recognition in Noise
 - Multi-talker babble preferred
 - Words (NU-CHIPS, WIPI, CNC, NU-6)
 - Sentence Level (Pediatric/Adult AZ Bio)
 - BKB-SIN

Testing in Noise



- ❑ Testing at 0 degrees azimuth
- ❑ Testing with noise at the “good” ear & speech at “poor” ear (Indirect)
- ❑ Testing with noise at the “poorer” ear & speech at “good” ear (Direct)

Additional Measures

- Functional Surveys & Questionnaires (Tharpe, 2019)
- Help identify areas of risk
 - Localization
 - Listening Difficulties
 - Educational Concerns
 - Fatigue
- Take into Account (Plyler & Plyler, 2023-2024)
 - Parental Report
 - Speech & Language Evaluations
 - Teacher Reports

Individualize your Battery & Recommendations

- “Decisions regarding RMS (remote microphone system) use for a child with UHL should be made on an individual basis.” (Bagatto et al., 2019)
- Functional testing is **CRITICAL** to making thoughtful individualized recommendations.
 - NOT individualizing recommendations can be detrimental
 - YOU are not the only person working with the child

Device Recommendations

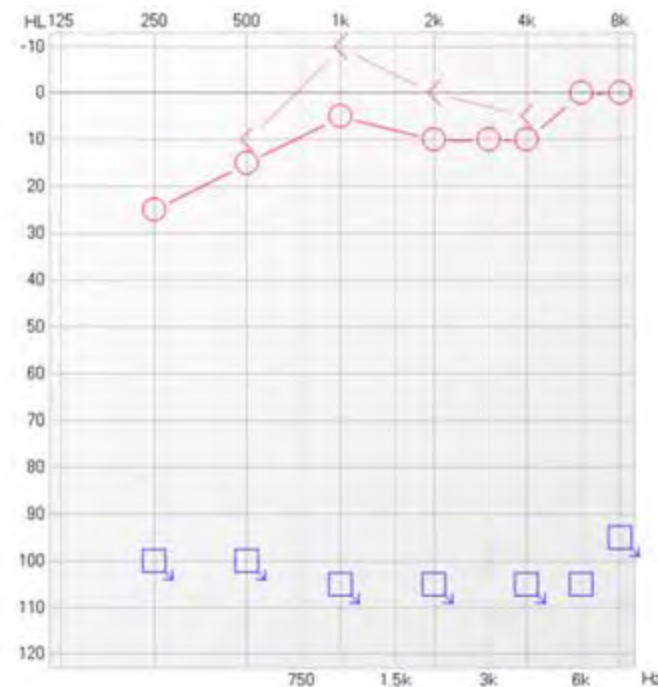
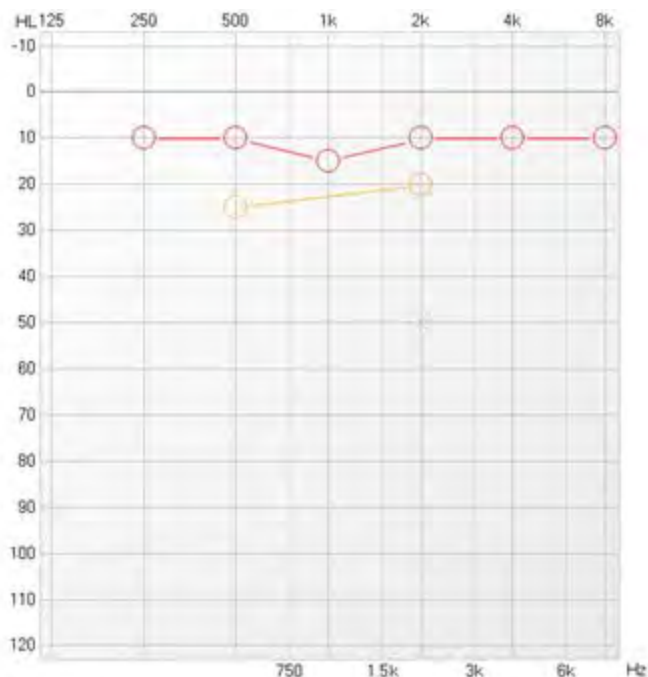
- Re-evaluating as children age
 - Listening demands are different
 - Environment is more uncertain
 - Many unfamiliar talkers
 - Students request access to more in their environment
 - Students are more aware of what they may be missing
 - I want to hear the kids on my right side
 - I'm missing information in the classroom
 - I am having trouble in the cafeteria

Case Studies

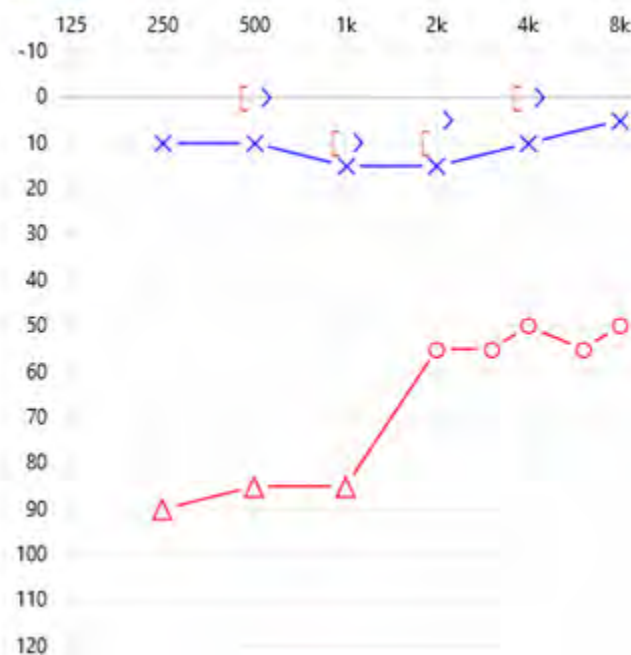
From Clinic to the Classroom



Case Studies



dsuite



Case 1

- Age 5
- Hearing
 - Microtia Atresia Right Ear
 - (Max Conductive Loss)
 - Normal Hearing Left Ear
- Device Recommended
 - Bone Conduction Device
- Above Avg Speech & Language Scores

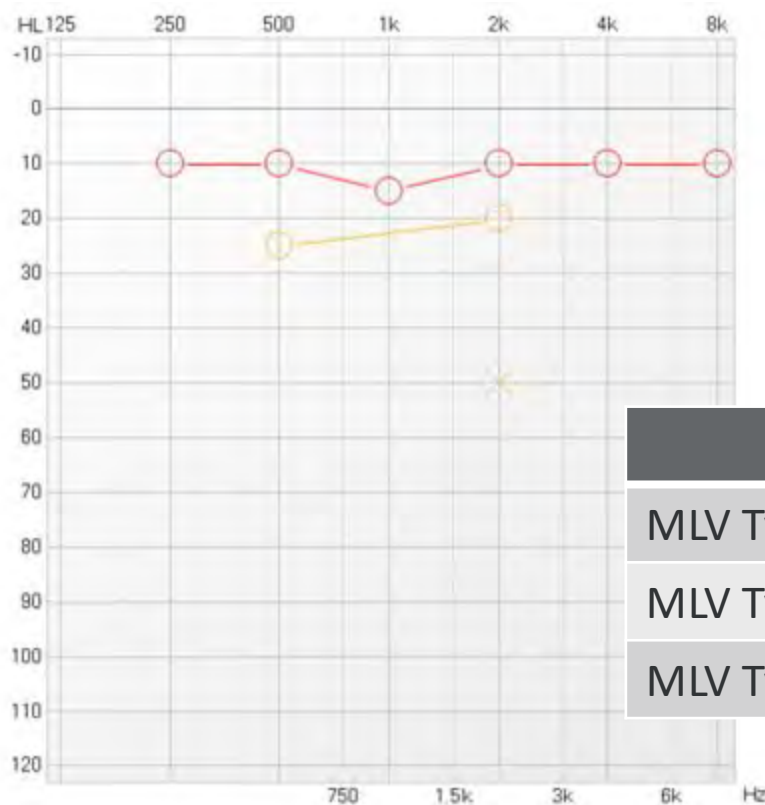


Test	Result
BKB-SIN Aided	0 dB SNR-LOSS
BKB-SIN Unaided	-1.5 dB SNR-LOSS
Aided MLV (Typical Level)	80%
Unaided MLV (Typical Level)	90%
Aided MLV (Soft Level)	90%
Unaided MLV (Soft Level)	100%

Case 1

- Tried
 - Baha 5
 - ADHEAR
 - Ponto – Edumic
- Enrolled in program within her school district that has multiple grades in one classroom
- In discussion with School Team
 - Most successful with sound field system at this time for whole group learning

Case 2



- Age 3 Enrolling In Mainstream Preschool
- Hearing
 - Normal Hearing Right Ear
 - ANSD Left Ear

Device options discussed, but none pursued

No Speech & Language Concerns

- TAF – Two Critical Elements

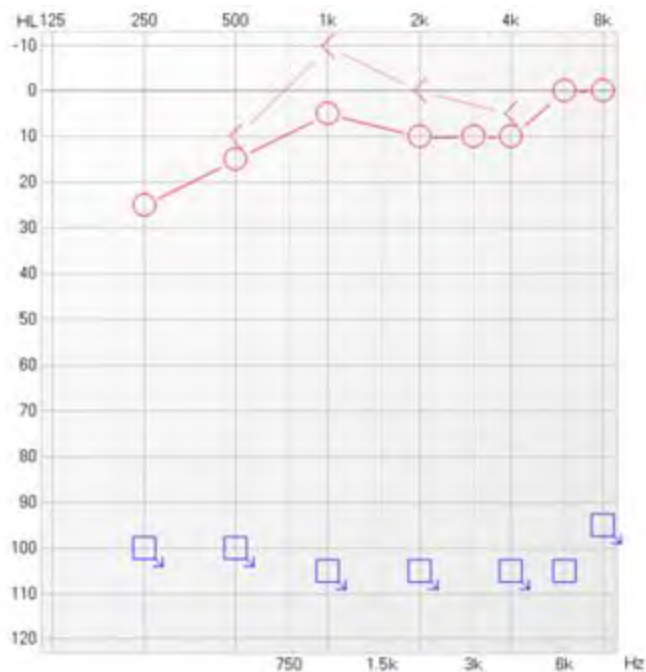
Test	Score
MLV Typical Level in Quiet	90%
MLV Typical Level in Noise	80%
MLV Typical Level in Noise w/ FM	80%*

Case 2

- Parents did not want a device at home
- Parents agreed to trial a Focus & Touchscreen in the “good ear” at daycare before preschool started
- Trialed FM/DM
 - Report from Team VERY Positive
- Recommendation
 - Start preschool with current system

Case 3

- Age 12
- Waardenburg Syndrome
- Came with a NAIDA SP BTE Left Ear
- Concerns regarding ADHD
- Reported no benefit with FM/DM system in School
 - FM was placed in the BTE only



Test	Right Ear	Aided Left Ear
CNCs 50 dB HL	97%	7%

Case 3

- Completed additional testing at a follow-up visit
- Recommended continuing use of hearing aid
- Recommended FM/DM for the RIGHT ear

Normal Level in Quiet Direct Ear	100%
Normal Level in Quiet Indirect Ear	81%
Normal Level in Quiet Right Ear ONLY	89%
Normal Level in Quiet Right Ear/Aided Left Ear	100%
Normal Level +10 SNR NO FM/DM	40%
Normal Level +10 SNR WITH FM/DM Right Ear	100%

Back to the Beginning..

Scooby presented with a moderately-severe hearing loss in his right ear and normal hearing in the left ear. Due to the unilateral hearing loss, Scooby will have difficulty hearing in noisy environments at school and localizing. The following is recommended:

- Scooby should receive preferential seating in school.
- Scooby should use an FM/DM system in school.

Functional Testing

BKB-SIN SNR-Loss: 1.1 dB

CNC Words	Right HA Only Normal Level	Both Ears Normal Level	Both Ears Soft Level
Total Phonemes	97%	100%	100%
Initial Consonants	100%	100%	100%
Final Consonants	90%	100%	100%
Vowels	100%	100%	100%
Total Words Correct	90%	100%	100%

AZ Bio Sentences

REC Normal Level in Quiet	100%
MLV Normal Level in Quiet	100%
MLV Soft Level in Quiet	99%
MLV Normal Level, Speech and noise from the front WITHOUT FM/DM	76%
MLV Normal Level, Speech from right, noise from left WITHOUT FM/DM	94%
MLV Normal Level, Speech from left, noise from right WITHOUT FM/DM	98%
MLV Normal Level, Speech and noise from the front WITH FM/DM	100%

Updated Recommendations

- 1) Strategic Seating: Scooby should be seated such that his left ear is given preference to his teachers and peers in the classroom. He should be allowed as much visual access as possible for lipreading and to visual materials and resources in the classroom. Teachers should give consideration to how the classroom is set up.
 - a) Seat Scooby away from any sound sources, such as HVAC systems or doorways to other classrooms.
 - b) In addition, during small group times, seat his group in a quiet place in the classroom.
 - c) He should be seated to the right side and front of the classroom, to ensure his better (left) ear faces his peers
- 2) Scooby should have access to a personal FM/DM system that goes directly to his hearing aid. Testing today demonstrated benefit with this setup for hearing assistive technology.

Summary & Take Homes

- Audiologists do not need to focus ONLY on fitting a personal device for students with UHL.
- The clinical audiologist plays an important role in diagnosing, fitting, and providing educational recommendations and **CAN & SHOULD** make recommendations for the classroom.
- Your report sets the stage for the plan that is put in place for the child outside of the clinic and in their classroom.

Summary & Take Home

- Every child should be treated *individually*
 - Not one device that fits all
 - Testing is critical to provide data to the family and school teams
 - You should be able to demonstrate benefit
 - Need to take into account not only the performance in the clinic, but how the device(s) impacts the child's function in different listening environments
 - Schools will value your information and perspective

THANK YOU!

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