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- Email [customerservice@SpeechPathology.com](mailto:customerservice@SpeechPathology.com)
Learning Outcomes

As the result of this continuing education activity, participants will be able to:

- Identify the various possible types and degrees of hearing loss.
- Describe basic concepts related to audiogram interpretation.
- Explain how to use audiologic information to plan management.
Main Ideas

- We establish type and degree of hearing loss not for its own sake, but to assist in selecting technology, planning therapeutic management, managing education, and advocating for positive audiological outcomes for the child.
  - Validity and reliability measures are critically important when evaluating applicability of any test protocol.
  - The whole point of technology (e.g. hearing aids, cochlear implants, FM systems, and bone anchored systems) is to get sound/spoken communication to the child’s brain.

Main Ideas (cont.)

- Children speak what and how they hear – if they speak “distorted”, likely the brain is receiving distorted sounds and deficient auditory information.
Quick Review From Part 1
Types of Hearing Loss

- Conductive hearing loss
  - Caused by damage to the outer and/or middle ear

- Sensorineural hearing loss
  - Caused by damage to the inner ear
    - Sensory HL – caused by damage to hair cells in the cochlear
    - Neural HL – caused by damage to the auditory nerve

- Mixed hearing loss
  - Combination of conductive and sensorineural HL

Describing Hearing Loss

- Pure tone average
  - 500, 1000 and 2000 Hz

- Description of hearing loss across all frequencies
  - eg – Mild to severe
  - Describe air and bone conduction HL

- Describe speech perception abilities
Unilateral Hearing Loss
Behavioral Evaluation

- Direct response of hearing measuring responses from the child
- Observation audiometry
  - Birth to 6 months (cognitive age)
  - Response – changes in sucking
- Visual reinforcement audiometry
  - 6 to 36 months (cognitive age)
  - Response – conditioned head turn
- Conditioned play audiometry
  - 30 months to 5-6 years (cognitive age)
  - Response – “listen and drop”
- Standard audiometry
  - > 5-6 years (cognitive age)
  - Response – hand raise or button push

Are The Tests Selected Valid Tests For Measuring What Is Intended To Be Measured?

Behavioral and Electrophysiologic Tests
- Are electrophysiologic tests sufficient to be used alone?
- Do behavioral and electrophysiologic tests provide the same results?
What Should We Be Looking For From Testing?

- Degree of hearing loss
  - Was the appropriate test used?
    - (BOA, VRA, Play, ABR etc.)
- Speech perception testing
  - Under earphones
  - In soundfield without technology
  - With technology
- Is the child hearing well enough to manage in a classroom?
- Ask to see test results – not just the report

What Does a Child Need To Hear To Do Well In A Classroom

- Children educated in the mainstream need to hear:
  - Normal conversation
  - Soft conversation
  - In noise
- If they do not hear well, they will have difficulty with:
  - Academic learning
  - Literacy
  - Socialization skills
What Is Normal Hearing?

- For children with normal hearing
  - 15 dB throughout the frequency range
  - Speech perception
    - Excellent at
      - Normal conversation (50 dBHL)
      - Soft conversation (30-35 dBHL)
      - In competing noise
  - Type A tympanogram
  - Normal otoacoustic emissions

What Do Children With HL Need to Hear?

- Aided thresholds at 20-25 dB
  - From 250-8000 Hz
- Speech perception
  - Good (80-89%) to excellent (90-100%) at
    - Normal conversation (50 dBHL)
    - Soft conversation (30-35 dBHL)
    - In competing noise
Can We Call It The Speech Bean?

What Happens If Hearing Is Not Good?

- Educational implications
  - Hearing in the classroom
  - Academic development
  - Literacy
- Social skills
Factors Which May Affect Speech Perception

- Degree of hearing loss
- Length of hearing loss
  - Length of profound hearing loss
- Experience with technology
- Demands on using audition
  - Educational setting
  - Family demands
- Language level
- Etiology of hearing loss
- Appropriateness of
  - Hearing aid settings
  - MAPping strategy, rate, etc.
- Experience of audiology and/or implant team

Suggested Speech Perception Test Protocol

- Monosyllabic words
  - Normal conversation 50 dBHL (R, L, B)
  - Soft conversation 35 dBHL (B)
  - Normal conversation 50 dB+5 SNR (B)
SUGGESTED SCORING
Madell et al 2011

- Excellent 90-100%
- Good 80-89%
- Fair 70-79%
- Poor < 70%

<table>
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<tr>
<td>Noise 50 dB+5S/N</td>
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</table>
MONITORING TECHNOLOGY

GOAL OF ASSISTIVE TECHNOLOGY

- Reduce sensory deprivation
- Provide auditory access sufficient for auditory learning
- Maximize use of residual hearing
- Lay foundation for auditory academic learning
- Facilitate socialization
- Facilitate information access/extended learning/incidental learning
- Safety
- Comfort
Identifying Problems With Technology

- Is technology doing what we want it to do?
  - Is child hearing at the string bean?
  - Can the child hear soft speech?
  - Can the child hear speech in noise?

How Do You Know If You Have Met Your Goals?

- Real ear or mapping
- Verification in the test booth
- Verification in the classroom
- Parent/teacher/child questionnaires
Case Studies

- Was the appropriate behavioral test used?
- Was the appropriate speech perception test used?
- Are test results reliable and valid?
- Were tests interpreted appropriately?
- Is the child receiving sufficient benefit with technology?
- Is the child hearing well enough to manage in a mainstream classroom?
Verification

- Thresholds
  - Is the child hearing high frequency sounds?
  - Is the child hearing softly enough to hear soft speech?
  - Is the child hearing well enough in each ear separately?
  - Are the ears matched?
  - Do they need to be?

5 Year Old Tested With VRA
Retest with CPA
Is it good enough?

NuChips – open set

- 50 dBHL: R 72%, L 52%, B 60% CNT
- 35 dBHL: CNT
- 50 dBHL+5SNR: CNT
L. Change in HA's

NuChips – open set 50 dBHL
- R: 92%  
- L: 92%  
- B: 100%
35 dBHL
- R: 92%  
- L: 92%  
- B: 80%
50 dBHL+5SNR

Is it good enough?
Insufficient gain

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<tr>
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Sufficient Gain
Fair-Good Speech Perception
Sufficient Gain
Fair-Good Speech Perception

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Matthew, 9 yrs
Mainstreamed 3rd grade
- Severe hearing loss
- Bilateral cochlear implants

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Matthew, 9 yrs
Mainstreamed 3rd grade

- Severe hearing loss
- Bilateral cochlear implants

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<tr>
<td>CNC 50 dB + 5SNR</td>
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Is it time for a CI?

- Is the child hearing well enough with hearing aids
  - For language learning
  - For academic learning
  - For socialization
- Can we change hearing aids or hearing aid settings to fix the problem?
- High frequency information?
- Is the child FM dependent?
### Table 1

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Andrew – 2 yrs

PBK  50 dBHL  MLV  Rec
R - CI  L - HA  B
88%  20%  60%  48%
Emma – 6 yrs

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Emma – 7 yrs

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<td>PBK 50 dBHL +5SNR</td>
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Noah 8 yrs

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<td>54%</td>
<td>88%</td>
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### Is it good enough?

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The Role of the SLP

- Monitor performance of children you work with
- Be certain they are hearing well enough to learn
- Communicate listening problems to audioligist, auditory verbal therapist, family
- Work on developing auditory skills

Thank You For Listening

Jane@JaneMadell.com
www.JaneMadell.com