STRATEGIES FOR TREATING CHILDREN WITH HEARING IMPAIRMENT IN THE SCHOOLS

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Agenda

- The effects of hearing loss
- Goals of Amplification
- Speech & language diagnostics
- Using specific techniques in auditory-based therapy
- The 3 Ts: Ensuring Success in Schools
- Trouble-shooting
- Optimizing the classroom
- Conclusion and Question & Answer
THE EFFECTS OF HEARING LOSS

Taking the Audiogram into school
PREVALENCE AND EFFECTS OF HEARING LOSS
Stats from National Institute on Deafness and Other Communication Disorders (NIDCD)

- Hearing loss affects approximately 17 in 1,000 children under age 18

- Incidence increases with age: Approximately 314 in 1,000 people over age 65 have hearing loss and 40 to 50 percent of people 75 and older have a hearing loss
Among African-American, Cuban-American, Mexican-American, Puerto Rican, and non-Hispanic White children, it is estimated that approximately 391,000 school-aged children in the U.S. have unilateral hearing loss.

According to Niskar and colleagues, approximately 14.9% of U.S. children have low-frequency or high-frequency hearing loss of at least 16 dB hearing level in one or both ears.
90% of infants born in the US are undergoing routine hearing screenings before leaving the hospital.

The overall estimates are between 1 to 6 per 1,000 newborns are born with congenital hearing loss.

In 2005, 2% of all infants (80,000) failed their hearing screening. 8,000-12,000 of those ultimately were diagnosed with some degree of congenital loss.
只有半数的家长会在及时的情况下回来做更详细的专业耳朵测试 - 可能要到3岁。

最近，这个比例已经提高到了66%。

为什么？

- 专业儿科听力学家的短缺
- 儿童听力学家的补偿不足
- 医生不知道要转介跟进
- 一些州仍然在建立他们的数据系统来跟踪和管理筛查程序
- 家庭对听力损失问题的意识不足
Hearing Aid Use

- MarkeTrak VII:

  - Only 12% of the hearing impaired pediatric population have hearing aids

  - 1.2 million children ages 0 to 17 in the United States:
    - parents admitted that their children had “hearing difficulties,” and
    - the children did NOT use amplification

  - The top three reasons for non-adoption of hearing aids are “minimization of hearing loss” (84%), “recommendations from a professional” (80%), and “degree or unique nature of hearing loss” (76%)
Assistive Listening Devices

- **MarkeTrak VII:**
  - About 1 in 3 students received some form of classroom assistance
    - 1/3 received preferential seating
    - But only 3 parents indicated assistive listening devices in the classroom
  
  - Improvements following implementation of the recommended intervention
    - grades (61%)
    - social skills (46%)
    - classroom behavior (51%)
    - self-esteem (49%)
15% of school-age children may fail a school hearing screening due to a transient ear infection.

Three out of 4 children experience ear infection (otitis media) by the time they are 3 years old (NIDCD).

Children who have early hearing impairment from frequent ear infections are likely to have speech and language disabilities (NIDCD).
<table>
<thead>
<tr>
<th>Factors that affect communication skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>- age of onset of hearing loss</td>
</tr>
<tr>
<td>- degree of hearing loss</td>
</tr>
<tr>
<td>- type of hearing loss</td>
</tr>
<tr>
<td>- bilateral/unilateral involvement</td>
</tr>
<tr>
<td>- other handicapping conditions</td>
</tr>
<tr>
<td>- family support</td>
</tr>
<tr>
<td>- services available</td>
</tr>
</tbody>
</table>
Effects of Hearing Loss

- Decreased speech perception abilities:
  - with greater degree of hearing loss
  - with increased amount of frequencies affected
  - with both ears affected
  - with increased distance between speaker and listener
  - with presence of noise
  - with group conversation
The Audiogram

- Audiogram: A graph that shows an individual's type and degree of hearing loss.

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**LEGEND / KEY**

BLUE is the standard used to signify the LEFT.
RED is the standard used to signify the RIGHT.

Test Result Markings used on your audiogram:

<table>
<thead>
<tr>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conduction</td>
<td>O</td>
</tr>
<tr>
<td>/ with masking</td>
<td>Δ</td>
</tr>
<tr>
<td>Bone Conduction</td>
<td>&lt;</td>
</tr>
<tr>
<td>/ with masking</td>
<td>[</td>
</tr>
</tbody>
</table>

While these symbols are the standard, they are not used by all hearing professionals. Please ask if they are right for your audiogram.

These graphs were done using a computer program for clarity. Unfortunately, sometimes the actual graph may be more difficult to read due to bad handwriting. If you cannot read your audiogram, please ask your hearing professional for assistance.
Normal Hearing
Mild Loss
Moderate Loss
Moderate Severe Loss
Severe Loss
Profound Loss
Normal Hearing

- When air and bone are both in the normal hearing range
Conductive Hearing Loss

- A barrier to sound present in the outer or middle ear
  - Normal inner ear function

- On the audiogram =
  - Normal bone conduction scores with Abnormal air conduction scores

- Can be a temporary or a permanent hearing loss which may be corrected medically or surgically
The Audiogram
Sensorineural Hearing Loss

- Impaired inner ear
  - Normal outer and middle ear sound pathway

- On the audiogram =
  - Abnormal bone conduction scores with abnormal air conduction that follows bone scores

- Nerve hearing loss which is permanent with no medical or surgical options to correct the loss
The Audiogram
Mixed Hearing Loss

- Abnormal outer, middle, and inner ear function

- On the audiogram =
  - Abnormal bone conduction scores and abnormal air conduction which is at least 15 dB worse than bone scores

- Temporary or permanent hearing loss with possibility of medical or surgical procedures for the conductive portion but not the nerve portion
The Audiogram
GOALS OF AMPLIFICATION

Make Speech Audible
Keep sound levels comfortable
“Speech Banana”

A diagram showing sound levels and frequency. The x-axis represents frequency in cycles per second (Hz), while the y-axis represents hearing level in decibels (dB). The graph includes various sound sources like a Quiet Bedroom at Night, Music, Lawnmower, Leaf Blower, and Airplane, each with their respective sound level and frequency distribution.
Aided thresholds as compared to unaided ear specific thresholds
Aided thresholds as compared to unaided ear specific thresholds
<table>
<thead>
<tr>
<th>Consonant</th>
<th>1st Formant</th>
<th>2nd Formant</th>
<th>3rd Formant</th>
<th>4th Formant</th>
</tr>
</thead>
<tbody>
<tr>
<td>/p/</td>
<td></td>
<td></td>
<td>1,500–2,000</td>
<td></td>
</tr>
<tr>
<td>/t/</td>
<td></td>
<td></td>
<td>2,500–3,000</td>
<td></td>
</tr>
<tr>
<td>/k/</td>
<td></td>
<td></td>
<td>2,000–2,500</td>
<td></td>
</tr>
<tr>
<td>/d/</td>
<td>300–400</td>
<td></td>
<td>2,500–3,000</td>
<td></td>
</tr>
<tr>
<td>/b/</td>
<td>300–400</td>
<td></td>
<td>2,000–2,500</td>
<td></td>
</tr>
<tr>
<td>/g/</td>
<td>200–300</td>
<td></td>
<td>1,500–2,500</td>
<td></td>
</tr>
<tr>
<td>/m/</td>
<td>250–350</td>
<td>1,000–1,500</td>
<td>2,500–3,500</td>
<td></td>
</tr>
<tr>
<td>/n/</td>
<td>250–350</td>
<td>1,000–1,500</td>
<td>2,000–3,000</td>
<td></td>
</tr>
<tr>
<td>/ng/ (wing)</td>
<td>250–350</td>
<td></td>
<td></td>
<td>4,500–6,000</td>
</tr>
<tr>
<td>/f/</td>
<td></td>
<td></td>
<td></td>
<td>4,000–5,000</td>
</tr>
<tr>
<td>/s/</td>
<td></td>
<td></td>
<td></td>
<td>5,000–6,000</td>
</tr>
<tr>
<td>/sh/</td>
<td></td>
<td></td>
<td>1,500–2,000</td>
<td>4,500–5,500</td>
</tr>
<tr>
<td>/th/ (thin)</td>
<td></td>
<td></td>
<td></td>
<td>6,000</td>
</tr>
<tr>
<td>/h/</td>
<td></td>
<td></td>
<td>1,500–2,000</td>
<td></td>
</tr>
<tr>
<td>/v/</td>
<td>300–400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/z/</td>
<td>200–300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/TH/ (that)</td>
<td>250–350</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/ch/</td>
<td>200–300</td>
<td></td>
<td>1,500–2,000</td>
<td>4,000–5,000</td>
</tr>
<tr>
<td>/dg/ (jot)</td>
<td>200–300</td>
<td></td>
<td>2,000–3,000</td>
<td></td>
</tr>
<tr>
<td>/l/</td>
<td>250–400</td>
<td></td>
<td>2,000–3,000</td>
<td></td>
</tr>
<tr>
<td>/r/ (err)</td>
<td>600–800</td>
<td>1,000–1,500</td>
<td>1,800–2,400</td>
<td></td>
</tr>
<tr>
<td>Vowel</td>
<td>Example</td>
<td>1st Formant</td>
<td>2nd Formant</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>-------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>/i/</td>
<td>bee</td>
<td>270</td>
<td>2290</td>
<td></td>
</tr>
<tr>
<td>/ɪ/</td>
<td>bit</td>
<td>390</td>
<td>1990</td>
<td></td>
</tr>
<tr>
<td>/ɛ/</td>
<td>bet</td>
<td>530</td>
<td>1840</td>
<td></td>
</tr>
<tr>
<td>/æ/</td>
<td>bat</td>
<td>660</td>
<td>1720</td>
<td></td>
</tr>
<tr>
<td>/ɑ/</td>
<td>box</td>
<td>730</td>
<td>1090</td>
<td></td>
</tr>
<tr>
<td>/ɔ/</td>
<td>bail</td>
<td>570</td>
<td>840</td>
<td></td>
</tr>
<tr>
<td>/u/</td>
<td>book</td>
<td>440</td>
<td>1020</td>
<td></td>
</tr>
<tr>
<td>/ʊ/</td>
<td>boot</td>
<td>300</td>
<td>870</td>
<td></td>
</tr>
<tr>
<td>/ʌ/</td>
<td>but</td>
<td>640</td>
<td>1190</td>
<td></td>
</tr>
<tr>
<td>/ɜ/</td>
<td>bird</td>
<td>490</td>
<td>1350</td>
<td></td>
</tr>
</tbody>
</table>
### Availability of Speech Information

**SPEECH INFORMATION**  
Availability at 250-4000 Hz (+ or 1 ½ octave)

<table>
<thead>
<tr>
<th>250 Hz</th>
<th>500 Hz</th>
<th>1000 Hz</th>
<th>2000 Hz</th>
<th>4000 Hz</th>
</tr>
</thead>
</table>
| • 1\textsuperscript{st} formant of vowels /u/ and /l/  
• Fundamental frequency of females and children's voices  
• Nasal murmur associated with the phonemes /m/, /n/, and /ng  
• Male voice harmonics  
• Voicing cues  
• Prosody  
• Suprasegmental patterns | • 1\textsuperscript{st} Formant of most vowels  
• Harmonics of all voices  
• Voicing cues  
• Nasality cues  
• Suprasegmentals  
• Some plosive bursts associated with /b/ and /d/ | • Important acoustic cues  
• 2\textsuperscript{nd} formants of back and central vowels  
• Voicing cues  
• Nasality cues  
• Suprasegmentals  | • Important acoustical cues for place of artic.  
• 2\textsuperscript{nd} and 3\textsuperscript{rd} formant info. for front vowels  
• CV and VC transition information  
• Nasality cues  
• Some plosive bursts  
• Voicing cues  | • Key frequency for /s/ and /z/ audibility (critical for language learning)  
• Plurals  
• Idioms  
• Possessives  
• Auxiliaries  
• 3\textsuperscript{rd} person  
• Singular verb forms  
• Questions  
• Copulas  
• Past perfect  
• Consonant quality |

Adapted from Ling (1996) Acoustics, Audition & Speech Reception (AVI)
Hierarchy of Listening Skills

- **Detection**: Respond to presence or absence of sound
- **Discrimination**: Perceive similarities and differences between two or more speech stimuli
- **Identification**: Label by repeating, pointing to or writing the speech signal heard
- **Comprehension**: Understand the meaning of speech by answering questions, following an instruction, paraphrasing or participating in a conversation

HOW A COCHLEAR IMPLANT WORKS
What a cochlear implant does

- A cochlear implant bypasses the damaged cochlear hair cells and uses electrical impulses to stimulate the auditory nerve.

- The goal is to restore sound detection and enable speech recognition.
How a Cochlear Implant Works

☐ microphone

☐ sound processor

☐ cable/coil or headpiece

☐ through skin

☐ internal device

☐ electrode array

☐ hearing nerve

1. external speech processor captures sound and converts it to digital signals

2. processor sends digital signals to internal implant

3. internal implant turns signals into electrical energy, sending it to an array inside the cochlea

4. electrodes stimulate hearing nerve, bypassing damaged hair cells, and the brain perceives signals; you hear sound
CI Components: Internal Device

- surgically implanted
  - internal circuitry
  - magnet
  - electrode array in cochlea
CI Components: External Devices

- Body Worn Sound Processors
CI Components – External Devices

- Behind-the-Ear Sound Processors
PARTS OF A HEARING AID

- Microphone
- Amplifier
- Receiver
- Battery
- Volume control
- Program Selector Switch
Styles of Hearing Aids

- ITE
- ITC
- CIC
- BTE
Audiological Appointment a Hearing Aid and FM Checkup

- Unaided hearing evaluation

- Check of Hearing Aid
  - Cleaning and replacing parts
  - New Earmold

- Verifying fit of hearing aid
  - Electroacoustically
Cochlear implants –vs.- Hearing Aids

- A hearing aid amplifies an acoustic signal, making it louder. The amplified signal travels down the ear canal, taking the normal route of transmission to the inner ear.

- A cochlear implant converts acoustic sounds into an electrical signal. The electrical signal is applied directly to the cochlea, so it bypasses the outer and middle ear.

- Cochlear implant recipients who had normal hearing at one time in their life report that sound through a cochlear implant is different than normal hearing. However, over time, they often say that speech begins to sound more like the way they remembered it.
From ASHA....

- Hearing Loss (if not properly amplified) causes delay in the development of receptive and expressive communication skills (speech and language).

- The potential language deficit causes comprehension and learning problems that result in reduced academic achievement.

- Communication difficulties may often lead to social isolation and poor self-concept.

- It may have an impact on vocational choices.
GOALS OF COMMUNICATION

Meeting the goals of children with hearing loss
Communication Options

- AVT
- Oral
- Cued Speech
- Total Communication
- Signed English
- American Sign Language

Auditory

Manual
The Goal for children with Hearing Impairment

- The current technology allows a child
  - To have access to spoken language
  - To learn to talk through listening
  - Listening is the major force in the development of the child’s personal, social, and academic life
Auditory Training in the Schools

What does not work?

- Serving young students with hearing impairment in non-categorical DD classes
- Following an alternative curriculum versus the regular curriculum
- Failure to communicate
- Random selection of regular classroom teachers
- Lack of parental support
Auditory Training in the Schools

- What it takes?
  - Family involvement
  - Administrative support
  - Be true to the support, yet flexible for individual needs
  - Work with and adjust the regular curriculum
  - Know what is expected of non-disabled peers
  - Pursue same goals, standards, and equal access for students with hearing impairment
  - Use appropriate amplification consistently
  - Attend to classroom acoustics when determining preferential seating
What tests to use and why
Remember:

- Before initiating the evaluation, check individual’s current amplification.
- Sit next to individual’s best ear and/or amplification.
- First, administer all tests using audition only.
  - use speechreading and/or signing cues if necessary in order to obtain accurate measurements.
Speech and Language Diagnostics

- Assessment includes:
  - Oral-Peripheral Exam
  - Voice/Fluency observation
  - Speech/Articulation
    - Identifying Early Phonological Needs in Children with Hearing Loss
    - Goldman Fristoe Test of Articulation, 3rd Edition
    - Structured Photographic Articulation Test-Dudsberry II
    - Arizona Articulation Test of Proficiency
    - Speech Sample
Diagnostics

- Auditory Perception Skills
  - Early Speech Perception Test
  - Meaningful Use of Speech Scale
  - Meaningful Auditory Integration Scale
  - Test of Auditory Comprehension
  - Ling 6 Sound Test
  - Auditory Perception Test for the Hearing Impaired-Revised
Diagnostics

- **Expressive and Receptive Language**
  - Preschool Language Scale-4
  - Clinical Evaluation of Language Fundamentals (CELF)-Preschool
  - CELF-4
  - Comprehensive Assessment of Spoken Language (CASL) 4th
  - Test of Language Development-Intermediate (TOLD-I)

- **Vocabulary:**
  - Expressive Vocabulary Test-2nd Edition (EVT-2)
  - Peabody Picture Vocabulary Test-4 (PPVT-4)

- **Basic Academic Concepts**
  - BOEHM
  - Bracken 3
SPECIFIC TECHNIQUES IN AUDITORY TRAINING

Performing auditory based therapy
Aural (Re) Habilitation is critical for success

- The primary function of the hearing technology is to provide spoken language information through hearing sensation and active listening

- The cochlear implant or hearing aid provides the hearing sensation and Therapy provides the tools for learning to listen
  - Must have an auditory component to therapy to get any benefit from the hearing technology
  - Cannot rely solely on visual input to improve communication with an implant or hearing aid
Integration of Learning

- Oral communication is not achieved by separating the processes of speech, speechreading, and listening from the overall context and process of communication (Kretschmer & Kretschmer, 1980).

- Oral communication should be integrated into the school and "life" curricula.

- "Speech instruction unrelated to the child's ongoing academic content violates recognized principles of learning.

- Synthesis of the child's developing audio-vocal system requires knowledge gained within the classroom“ . (Mulholland, 1980)

The development of oral communication depends upon the individual student's access to a maximized and consistent auditory signal.
Integration of Learning

- The models described that are relevant to students with hearing impairments include:
  - Team teaching (clinician and teacher)
  - One-to-one intervention within the classroom
  - Consultation with the classroom teacher
  - Staff development.

- Advantages:
  - More opportunities to use oral communication
  - Teachers overall knowledge of students skills
  - Facilitates oral language learning in natural settings and through normal adult-child and peer interactions
Ling 6 Sound Test

- Allows a quick and easy way to check that a person is able to detect and identify sounds within the speech range.
- Provides information regarding an individual's distance of hearing or earshot.
- Results ensure that hearing aid and/or CI is functioning properly and individual is receiving maximum benefit from his/her device.
- Represents all frequencies across the speech banana: /a/, /i/, /u/, /s/, /m/, ‘sh’
- Video
Auditory Strategies

- Decrease distance to child
- Ling 6 Sound Test
- Use short phrases
- Repetition
- Ask, What did you hear?
- Use a closed-set
- Auditory Highlighting (stress, inflection)
- Use the “Sandwich Technique”
Language Development in Children with Typical Hearing

- Bloom & Lahey Model (1978):
  - Helpful in showing how the key language skills interrelate. Bloom and Lahey describe three areas:
    - 'Form': grammar, shown in word order, word endings, verb tenses. This is the ability to put together a grammatical sentence
    - 'Content': picking the right words to get the message across. This involves use of vocabulary and concepts. These are words with meaning. We need to understand the meanings of words and be able to use these words to create what we want to say.
    - 'Use': making use of language in a variety of different ways, such as for greeting, describing, arguing. Using language also involves subtle communication such as the use of body language, facial expression, tone of voice and non-literal language as well as knowing how to take turns in talking.
Development of Speech Skills in Typically Hearing Children

**Ages of Consonant Acquisition**

<table>
<thead>
<tr>
<th>Age 3:</th>
<th>p m n h w and all of the vowels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 4:</td>
<td>b k g d f y</td>
</tr>
<tr>
<td>Age 6:</td>
<td>t r l j</td>
</tr>
<tr>
<td>Age 7:</td>
<td>ʧ ʃ ʤ ð j</td>
</tr>
<tr>
<td>Age 8:</td>
<td>s v z</td>
</tr>
</tbody>
</table>

**Major Stages of Speech Acquisition**

<table>
<thead>
<tr>
<th>Phonetic</th>
<th>Phonologic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vocalizes freely and on demand</td>
<td>Uses vocalization as a means of communication</td>
</tr>
<tr>
<td>2. Bases of suprasegmental patterns</td>
<td>Uses different voice patterns meaningfully</td>
</tr>
<tr>
<td>3. All vowels and diphthongs with voice control</td>
<td>Uses different vowels to approximate words</td>
</tr>
<tr>
<td>4. Consonants by manner with all vowels</td>
<td>Some words said clearly with good voice patterns</td>
</tr>
<tr>
<td>5. Consonants by place with all vowels</td>
<td>Some phrases said clearly with good voice patterns</td>
</tr>
<tr>
<td>6. Consonants by voicing with all vowels</td>
<td>Some sentences said clearly with good voice patterns</td>
</tr>
<tr>
<td>7. Initial and final blends</td>
<td>All speech intelligible and voice patterns natural</td>
</tr>
</tbody>
</table>

(Ling, 1989 Foundations of Spoken Language)
Development of Speech Skills in Typically Hearing Children

<table>
<thead>
<tr>
<th>Consonants differing by MANNER only</th>
</tr>
</thead>
<tbody>
<tr>
<td>b-m</td>
</tr>
<tr>
<td>m-w</td>
</tr>
<tr>
<td>b-w</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consonants differing in MANNER and VOICING</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consonants differing by VOICING only</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-b</td>
</tr>
<tr>
<td>s-z</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consonants differing by PLACE only</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-t</td>
</tr>
<tr>
<td>p-k</td>
</tr>
<tr>
<td>t-k</td>
</tr>
</tbody>
</table>
## Normal Developmental Sequence of Expressive Language

<table>
<thead>
<tr>
<th>INPUT</th>
<th>1. SENSE</th>
<th>2. DICTATE</th>
<th>3. FIRESTORY</th>
<th>4. PRECURSORY</th>
<th>GOALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTION</td>
<td>LOCATION</td>
<td>STATE</td>
<td>STATE</td>
<td>PLAN</td>
<td>SURVIVAL</td>
</tr>
<tr>
<td>TELL</td>
<td>KNOW</td>
<td>WHAT</td>
<td>WHERE</td>
<td>WHEN</td>
<td>HOW</td>
</tr>
<tr>
<td>SENSE</td>
<td>DICTATE</td>
<td>FIRESTORY</td>
<td>PRECURSORY</td>
<td>GOALS</td>
<td>INPUT</td>
</tr>
</tbody>
</table>

This chart outlines the normal developmental sequence of expressive language, indicating the progression of language development. Each column represents a different aspect of language development, with detailed notes on the specific actions, locations, and states associated with each stage. The chart highlights the importance of sensory input in the development of language sequences, emphasizing the role of the observer in the learning process.
Goals for Older Elementary Children

- Developing speech and auditory skills in presence of noise.
- Enhance voice quality
- Conversational repair strategies
- Paraphrasing
- Story-telling and retelling
- Higher level auditory/cognitive skills
- Learning school based subject material
THE 3 T’S TO ENSURE SUCCESS IN SCHOOLS

The Team----The Terms----The Tools
Primary Age
(3 years to 6/7 years of age)

- The Team
  - Parent/Child
  - AV Therapist and/or SLP
  - Audiologist
  - ENT
  - OT/PT, if needed
  - Teacher of the Deaf
  - Classroom Teacher
  - Educational Psychologist
  - School Administrator
Primary Age
(3 years to 6/7 years of age)

The Terms
- Hearing Age/Cochlear Implant Age vs. Chronological Age
- IEP (Individualized Education Plan)
  - Least restrictive environment
  - Accommodations/Modifications
  - Extended School Year
- FM Systems/Assistive Listening Devices
- Pre-literacy skills
- Preteaching vocabulary/concepts
Primary Age
(3 years to 6/7 years of age)

- The Tools

- Creating an optimal listening environment
  - Preschool class:
    - tennis balls on chairs
    - furniture moving
    - drapes
    - corkboards
Primary Age
(3 years to 6/7 years of age)

- **Tools:**
  - Activities for targeted skills
    - Phonemic Awareness Skills
      - Rhyming Words
      - Reciting Rhymes/songs
      - The “alphabet game”
Primary Age
(3 years to 6/7 years of age)

- **Tools**
  - **Self-Advocacy Skills**
    - Asking for help
    - Signaling amplification is not working
    - Stating “I didn’t hear that”
      - Book, “I’m the Boss of my Hearing Loss” by Amy Kroll
      - [www.coolgal.biz](http://www.coolgal.biz)
Elementary School Age
(6-11 years of age)

- The Team
  - Parent/Student
  - AV Therapist and/or SLP
  - Educational Audiologist
  - ENT
  - OT/PT, if needed
- Teacher of the Deaf
- Classroom Teacher
- Guidance Counselor
- Peer Buddy (grade 3-4)
- Interpreter/Trans-facilitator
- Educational Psychologist
- School Administrator
Elementary School Age
(6-11 years of age)

- The Terms
  - IEP (Individualized Education Plan)
    - Least restrictive environment
    - Accommodations
    - Extended School Year
  - Note Takers
  - Captioning
  - Teacher Notes and Scripts
  - Elements of Literacy
  - Troubleshooting
  - Preferential Seating
  - Signal to Noise Ratio
  - Self-Advocacy
  - Repair Strategies
  - Graphic Organizers
Elementary School Age
(6-11 years of age)

- The Tools
  - Creating an optimal listening environment
    - Preferential Seating:
      - Back to wall
      - Not near air condition
  - Self Advocacy Skills
    - Repeat what was heard
    - Asking for help
    - FM system
Elementary School Age (6-11 years of age)

- The Tools
  - Pick your spot: Diagram of the classroom
  - Signs of Giftedness

- Note taking:
  - Graphic Organizers
  - Taking Notes
  - Learning to Learn
  - Teaching them to Think
    - Inferential Reasoning
Middle to High School
(12-18 years of age)

- The Team
  - Parent/Student
  - AV Therapist and/or SLP
  - Educational Audiologist
  - ENT
  - OT/PT, if needed
  - Job Coach
  - Coach
  - Teacher of the Deaf
  - Classroom Teacher
  - Guidance Counselor
  - Peer Buddy (grade 3-4)
  - Interpreter/Trans-facilitator
  - Educational Psychologist
  - School Administrator
Middle to High School
(12-18 years of age)

- The Terms
  - Suprasegmentals: Poetry
  - ASL/ESL
  - Second Language Requirement
  - Captioning
  - 504 Plans
Middle to High School
(12-18 years of age)

- The Tools
  - Pre-teaching
  - Key words (words to look for and highlight)
  - Vocabulary
  - Contextual clues in the text
  - Studying strategies (SQ3R)
  - Advocacy
  - Provide support and strategies for successful social interactions
  - Latin stems and roots to assist in decoding chunks in technical reading
TROUBLESHOOTING SPEECH/LANGUAGE ISSUES

When there are problems in therapy
Ensuring Success

- Ensure goals are appropriate for child’s ability level
  - Auditory development/listening skills (NOT behavior-related)

- Ensure amplification is appropriate
  - Auditory discrimination
  - Observe Patterns of Errors

- Monitor auditory environment for therapy
  - Background noise
  - Group environment
  - Positioning
Vocabulary

- Vocabulary develops more slowly in children who have hearing loss.

- Children with hearing loss learn concrete words like cat, jump, five, and red more easily than abstract words like before, after, equal to, and jealous. They also have difficulty with function words like the, an, are, and a.

- The gap between the vocabulary of children with normal hearing and those with hearing loss widens with age. Children with hearing loss do not catch up without intervention.

- Children with hearing loss have difficulty understanding words with multiple meanings. For example, the word bank can mean the edge of a stream or a place where we put money.
Children with hearing loss comprehend and produce shorter and simpler sentences than children with normal hearing.

Children with hearing loss often have difficulty understanding and writing complex sentences, such as those with relative clauses ("The teacher whom I have for math was sick today.") or passive voice ("The ball was thrown by Mary.")

Children with hearing loss often cannot hear word endings such as -s or -ed. This leads to misunderstandings and misuse of verb tense, pluralization, nonagreement of subject and verb, and possessives.
Auditory Fatigue

- Alternate heavy listening demands with quiet activities
- Allow downtime privileges (quiet place)
- Reduce background noise like music
- Give extra processing time (e.g. pausing)
- Keep directions clear and short
Group Discussions

- Call on child by name and point to them
- Rephrase and/or repeat what others have said
- Pass the FM microphone when appropriate
- Draw attention to changes in topic
- Encourage children to look at speaker when listening
Language Gaps/Vocabulary

- Communication with Team for pre-teaching purposes
- Use visual aids as much as possible
- Rephrase information and new words in several ways
- Write new vocabulary on board/paper as it arises
- Check comprehension periodically
- Create a “secret signal” so that child can indicate when they don’t understand
Speaking

- Children with hearing loss often cannot hear quiet speech sounds such as "s," "sh," "f," "t," and "k" and therefore do not include them in their speech. Thus, speech may be difficult to understand.

- Children with hearing loss may not hear their own voices when they speak. They may speak too loudly or not loud enough. They may have a speaking pitch that is too high. They may sound like they are mumbling because of poor stress, poor inflection, or poor rate of speaking.
Academic Achievement

- Children with hearing loss have difficulty with all areas of academic achievement, especially reading and mathematical concepts unless appropriate educational intervention occurs early.

- Children with mild to moderate hearing losses, on average, achieve one to four grade levels lower than their peers with normal hearing, unless appropriate management occurs.

- Children with severe to profound hearing loss usually achieve skills no higher than the third- or fourth-grade level, unless appropriate educational intervention occurs early.

- The gap in academic achievement between children with normal hearing and those with hearing loss usually widens as they progress through school unless appropriate educational intervention occurs early.

- The level of achievement is related to parental involvement and the quantity, quality, and timing of the support services children receive.
Children with hearing loss (without the appropriate amplification) often report feeling isolated, without friends, and unhappy in school, particularly when their socialization with other children with hearing loss is limited.

With appropriate amplification, children with hearing loss can actively engage with their typically hearing peers and develop normal socialization and pragmatic skills.
Quality of Life for Children with Hearing Impairment

- Children (aged 5-14) perceive the benefits of amplification
  - Children appreciated global effects of implant
    - Increased speech perception
    - More accurate identification of others’ emotions
    - Decreased social isolation due to increased ability to interact with same-aged peers

- Age of Implant does not predict benefits or problems, but does correlate with higher quality of life scores

# Quality of Life Scale

<table>
<thead>
<tr>
<th>The Cochlear Implant Helps you:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get less mad/frustrated or upset when others do not understand you.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Use the telephone.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Say words more clearly so people can understand you.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Be part of more activities like sports, piano lessons, or dancing.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Understand what other people are saying.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Make new friends.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Hear sounds in the environment (baby crying, doorbell, horns, etc.).</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Scoring Continuum:**
1= no help; 2= some help; 3= moderate help; 4= quite a bit of help; 5= great help

TROUBLESHOOTING
SOUND PROCESSORS
Basic Sound Processor Components

- Speech Processor
- Microphone
- Body Cables and/or BTE Cables
- Headpiece, Cable, and Magnet OR Cable/Coil and Magnet
- Batteries
Basic Sound Processor
Controls/Options

- Program Selection
- Volume
- Microphone Sensitivity
- Telecoil On/Off
- Aux Audio Input
- Battery Connection
Maintenance and Troubleshooting of the SP

- The SP needs to be checked everyday to ensure optimal sound quality
  - batteries charged, cables good, microphone clear, volume settings appropriate
- If any part of the system is malfunctioning, the recipient will not hear properly
  - hear intermittently, static, not at all
- Don’t forget to try the spare speech processor and parts to compare to the “broken” one
  - Need to know if it is an equipment issue or a mapping issue
The Steps to Check the Speech Processor

- **Visual inspection**
  - Are the Speech Processor, Coil, and Cables, (and ear mold for retention) in good condition or are they frayed, cracked, or broken in any way?
    - Change cables and/or coils if needed
  - Are the settings of the SP appropriate – program selection, volume, sensitivity, t-coil?
    - Need to know rec’s on program selection from AUD
- **Battery Inspection**
  - Are the batteries charged?
  - Are the batteries inserted correctly?

- **Microphone Inspection**
  - Use monitor ear phones to test mic on all programs
  - Listen for distortion or intermittency

- **Behavioral Test**
  - functional gain test/aided audiogram
  - Ling 6 Sounds

- **Signal Check/Sensor or LED display**
  - To look for transmission of signal
The Things to Have on Hand

For each type of processor:

- Microphone tester and/or Lapel microphone
- Charged or new batteries
- New body cables and headpiece cables, BTE Cable, and Cable/Coils
- New Coil or Headpiece
- New specialty earhooks (t-mics, direct connections, etc) or accessories
The Places to Look for Help

- The manufacturer (website manual and informational downloads or call and ask for support)
  - Cochlear Corp:
    - 1-800-523-5798
  - Advanced Bionics:
    - 1-800-678-2575
  - Med-El:
    - (888) MED-EL-CI (633-3524)

- The recipient’s manuals

- The recipient’s audiologist
General Maintenance and Precautions

- Water/moisture
  - Use a Dehumidifier/Dry Aid Kit every night!

- Protection of speech processor and cables

- Magnets in environment or in medicine

- Other medical procedures

- Head protection from trauma (sports)

- Static electricity
OPTIMIZING THE CLASSROOM

Classroom acoustics
Classroom modifications
Classroom Modifications

- Things that affect hearing in the classroom:
  - Noise
  - Distance
  - Reverberation
Noise

- Classroom Acoustics

- Signal to Noise ratio is unfavorable
  - classroom noise is around 55 dB
  - but voices are only at around 70 dB or less
  - this means the teacher’s voice is heard at 15 dB which is a whisper
Distance

- As distance increases, loudness decreases
  - The teacher is usually around 6-10 feet from the students
  - For every doubling of distance the intensity of the sound decreases by 6 dB

- Not all speech sounds will get to the students ear level microphone at the appropriate loudness level
  - High pitch consonants (f, s, sh, p, t, th, k) are much softer than vowels
Reverberation

- Hard walls, windows, and uncarpeted floors reflect sound and produce echoes

- Some reverberation is good
  - echoes that occur in less than 0.2 seconds can help increase loudness

- A lot of reverberation is bad
  - the average reverberation in classrooms is 0.8 seconds
How can we improve these factors in the classroom?

- **Personal FM systems**
  - Most appropriate for children with Hearing Aides and Cochlear Implants

- **Soundfield FM systems**
  - Benefits all children in the classroom (even children with language or articulation concerns and second language learners)

- **Improve Classroom Acoustics**

- **Maintenance and Troubleshooting of the Speech Processor and assistive listening devices**
Personal FM System

- The teacher wears a microphone and FM transmitter
  - Child continues to have access to incidental classroom information (peers commenting, spontaneous conversations)
- The student wears a personal receiver that is connected to his/her speech processor
- The sound is transmitted via radio signal
- The teacher’s voice is directly amplified by the speech processor
- Minimal distraction for other students
Considerations

- the FM may or may not allow the student to also hear the environmental sounds along with the teacher’s voice
  - the student may miss out on incidental language if the teacher’s voice is the only input
  - FMHA setting allows child to hear the teacher’s voice louder than the background noise ("FM only" eliminates background noise)
    - Environmental sounds depend on the program-settings of the device
    - Teacher can choose the directionality of the microphone to allow more or less background noise
- there may be electromagnetic interference from fluorescent lighting and computer equipment
- troubleshooting may be difficult and confusing
Soundfield FM Systems

- The teacher wears a microphone and FM transmitter

- An FM receiver is connected to loudspeakers
  - The speakers may be placed around the classroom
  - or be a portable speaker that the student may place on his/her desk and carry from class to class
Considerations

- The signal to noise ratio may not be as great as with a personal FM system.

- Incidental language may be utilized by the student.

- Benefit to other students.

- Placement of the speakers is critical.

- Easy to use.
Using the Teacher’s FM System Microphone

- Worn 6 inches from the mouth pointing upward toward the mouth
  - Clipped to the collar or in a lavaliere style

- Ensure that no jewelry is bumping or clothes are rubbing the microphone
  - This is amplified and sent to the student

- The cables need to be checked consistently
  - They are the weakest part of the system
Improving Classroom Acoustics

- Close the classroom door

- Cover hard, reflective surfaces with sound absorbing material
  - acoustic tiling, cloth, paper, carpeting, cork

- Cover windows with curtains and floors with carpet
  - Fire-resistant material
Chair feet may be padded to reduce noise from movement

Use cork or felt to line desks and reduce noise from opening and closing

Place noise baffles in air ducts

Ensure optimal placement of soundfield speakers
Facilitating Auditory Skills in the Classroom

- Use verbal cues to get the child’s attention
- Be aware of environmental sounds
- Consider an FM System
- Begin with common phrases
- Provide vocabulary to describe and label sounds within the classroom/school
- Encourage the child to ask questions
- Expectations for verbal contributions
- Pre-teach Concepts
- Repeat student answers to teacher directed questions
- Write key words, due dates, announcements on board
Integrating an Auditory Approach in Your School

- Curriculum and Administrative Accommodations

- Classroom Modifications to Promote an Optimal Listening and Learning Environment

- Classroom Interventions to Facilitate Auditory Skills in the Classroom
Internet Resources

- http://www.listen-up.org
- http://www.hearingjourney.com/Listening_Room/index.cfm?langid=1
CONTACT US

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