

Mississippi Speech-Language-Hearing Association

Position Statement: Best Practice for Fitting Infants/ Children with Hearing Aids

This document was prepared by the Mississippi Speech-Language-Hearing Association regarding Pediatric Amplification. The specific goal of this document is to provide a set of recommendations for best practices specific to the fitting and dispensing of amplification, including verification, as part of a comprehensive treatment plan for the audiologic management of children with hearing loss. This document was compiled by reviewing current best practice recommendations by the American Academy of Audiology and American Speech-Language-Hearing Association. This position statement addresses the process of hearing aid selection, fitting, verification, and outcomes assessments. This guideline does not directly address treatment with cochlear implants, but does touch on the use of cochlear implants in conjunction with a hearing aid on the contralateral ear. This document is meant to be a guideline for how hearing aids should be selected, verified, and validated; however, the clinician should make individualized decisions for each patient. When selecting any treatment approach, the audiologist should consider and incorporate the family's goals, preferences, values, beliefs, culture, and linguistic background.

Audiologic Candidacy Criteria

The purpose of providing amplification for children is to minimize the negative impacts of hearing loss on communication development and academic achievement. Amplification should be considered for any type or degree of hearing loss that could possibly interfere with normal development, including minimal/mild hearing loss, unilateral hearing loss, or Auditory Neuropathy Spectrum Disorder. Attempts should be made to fit hearing aids within one month of diagnosis. Loaner hearing aids can be provided until financing is secured, to avoid a delay in fitting. Children with severe or profound hearing loss, who may not achieve sufficient benefit with hearing aids, should be referred for a cochlear implant evaluation, assuming parent/caregiver preference.

1. Unilateral hearing loss - Children with aidable unilateral hearing loss should be considered a candidate for amplification in the impaired ear due to the risks for delayed speech and language acquisition, as well as academic difficulties. For children with severe to profound hearing loss and normal hearing in the opposing ear, other solutions such as contralateral routing of signal or FM system, may be considered based child's age and ability. Additionally, off-label solutions such as cochlear implantation, may be a viable option.
2. Minimal/ Mild hearing loss - Children with minimal and mild hearing loss are at high risk for experiencing academic difficulty and may be considered candidates for amplification systems and/or FM systems.
3. Auditory Neuropathy Spectrum Disorder (ANSD) - Due to the nature of ANSD, an auditory brainstem response (ABR) cannot adequately estimate hearing sensitivity of this population. Additionally, the presence or absence of otoacoustic emissions in children with ANSD is not a valid estimate of behavioral thresholds. Amplification should only be provided based on behavioral observations (by the clinician and by parents) until reliable behavioral thresholds can be established. Children with ANSD may or may not demonstrate improvements in speech understanding with the provision of amplification. Based on the potential for improved speech recognition and the difficulty in predicting hearing aid benefit, a trial with appropriately fit amplification for children with ANSD is recommended prior to candidacy evaluation for cochlear implantation. Until hearing thresholds can reliably be established, careful observation of the

responsiveness of the child to sounds while wearing hearing aids is essential, with adjustments as necessary.

4. Children with permanent conductive hearing loss should be fit with air conduction hearing aids when anatomically possible. Bone conduction hearing aids should be fit if anatomy is insufficient for coupling.
5. All potential candidates for a cochlear implant should receive a trial with amplification prior to implantation, to determine if sufficient benefit is obtained from appropriately-fit hearing aids. A finding of “No Response” by auditory brainstem response (ABR) does not exclude a child from hearing aid candidacy, as residual hearing may exist at intensity levels greater than those capable of being elicited using standard ABR. The threshold levels used to prescribe amplification for a no response ABR should be equal to the lowest-intensity stimulus level where no response is observed for each frequency tested, except in the case of children with ANSD where the absence of an ABR does not carry any implications about hearing thresholds.

Hearing Aid Evaluation

The routing of the signal may include air conduction, bone conduction, electrical stimulation or some combination of these methods. Bilateral amplification is recommended for children with bilateral hearing loss unless there is a clear contraindication. Monaural fittings may be warranted based on specific patient needs or in cases of asymmetry with potential binaural interference. Medical clearance from a physician is necessary prior to the fitting of amplification. It is best practice for a child to be evaluated by an ear, nose, and throat physician, particularly at the time of initial identification. The goal of amplification is to provide access to sounds important for speech/language development.

Amplification compatible with FM technology (behind-the-ear style) is strongly encouraged for school-aged children. The use of additional features, such as frequency lowering, volume control, directional/omnidirectional microphones, etc, should be determined on an individual basis.

1. Bilateral amplification is recommended unless contraindicated.
2. Sound transmission is chosen based on type and severity of the hearing loss and physical features of the outer ear. Bi-modal sound transmission (CI on one side and hearing aid on the other) is recommended for children unilaterally implanted unless contraindicated.
3. For a child with unilateral deafness, an FM system with the wireless remote microphone receiver coupled to the open, good ear may be preferable to a CROS configuration in classroom situations.
4. Use of a bone conducted signal may be an effective means of amplification for children with permanent bilateral conductive hearing loss.
5. Use of a bone conducted signal may be considered an option with children who have unilateral hearing loss.
6. Use of a cochlear implant may be an off label option for children who have unilateral hearing loss.

Recommendations for Hearing Aid Style

1. Behind-The-Ear (BTEs) are the style of choice while the child’s ear is still growing.
2. BTEs may provide needed features for the pediatric patient.
3. Standard BTEs may provide appropriate coupling to a variety of assistive listening devices that may assist in educational and social settings. Not all Receiver-In-The-Ear/ Receiver-In-Canal (RITE/ RIC) or mini-BTEs/ mini- RITEs/ mini-RICS will have the ability to couple to assistive devices.

4. Tubing size, occlusion, and receiver placement are individual choices based on patient age, ability, communication needs, ear canal dimensions, hearing loss severity/ configuration, and patient preferences.

Recommendations for earmold

1. Be proactive regarding earmold replacement due to the child's growth.
2. Use of automatic feedback suppression should not be used in place of obtaining a properly fitting earmold. This feature can be helpful to resolve feedback issues in the presence of a properly fitting earmold or while temporarily awaiting new earmolds.
3. Approach venting cautiously in pediatric earmolds because of space limitations.
4. Provide a long, but comfortable earmold canal length to reduce the occlusion effect and to provide increased output in the ear canal.
5. Use of pediatric ear hooks is recommended to promote retention of BTEs.
6. Use of filtered ear hooks is recommended to ensure a smooth frequency response.

Recommendations for safety considerations

1. Utilize tamper resistant battery doors to decrease the likelihood of battery ingestion.
2. De-activate or lock volume controls.
3. Use a validated, pediatric-focused prescriptive formula and account for the real-ear to coupler difference (RECD) when prescribing gain or output for a child in order to avoid overamplification.
4. Monitor temporary threshold shift (TTS) if overamplification is suspected.
5. Attempt to reduce parental/caregiver anxiety through counseling and instruction.
6. Provide parents/caregivers with tools and instructions to ensure functioning hearing aids.

Recommendations for Fitting/Verification

1. Prescription methods: Independent pediatric-focused and pediatric-validated prescriptive targets, such as the Desired Sensation Level (DSL) or National Acoustics Laboratories (NAL) prescriptions should be used for pediatric hearing aid fitting and verification. These prescriptive approaches are audibility based and account for the physical differences between children and adults.
2. Verification methods: The response of the hearing aid should be measured for a variety of input levels to estimate the audibility of speech and ensure that the maximum output does not exceed prescribed levels. For children, there are two options for hearing aid verification:
 - a. Real-ear aided response (REAR) probe microphone measurements (when possible) – The output of the hearing aid is measured in the child's ear (in situ) using a probe microphone. The response of the hearing aid should be measured for a variety of input levels, minimally for average level speech input and maximum power output of the hearing aid.
 - b. Simulated real-ear aided response measurements in the coupler using measured or age-appropriate real ear to coupler difference (RECD). Simulated test-box measures should be completed to verify hearing aid settings for soft, average, and loud speech stimuli and for maximum output limits.

SPECIAL CONSIDERATIONS IN VERIFICATION

1. High Frequency Audibility: Children use their hearing to develop communication and to support learning. The importance of providing audibility for the high frequency cues of speech is greater for the pediatric population. Children who use hearing aids require more high frequency

audibility, and derive more benefit from audibility of high frequency cues when they are provided. Children who are fit with hearing aids that fail to render audibility to the full set of speech cues are at risk of deficits in speech production and/or learning.

2. Verification of advanced features: The impact of hearing aid signal processing and features such as directional microphones, digital noise reduction, feedback suppression and frequency lowering on audibility should be verified, if these features are determined to be appropriate. If the signal processing strategy includes automatic activation of any features, verification of feature activation should be included.
3. Verification Test Signal: A standard real speech or a speech-like signal should be used when attempting verification of prescriptive methods for which the targets are based on speech inputs.
4. Aided Audiogram: Measurement of aided sound field thresholds should not be used as a method of hearing aid verification, for traditional amplification. In cases of bone conduction hearing aids, real-ear probe microphone measures cannot be conducted (when there is no acoustic signal in an ear canal), and the aided audiogram may be the most readily available verification option. In spite of its limitations, the aided audiogram can provide information, and in the case of bone conduction and frequency transposition/compression hearing aids, may be the most valid way to quantify the aided response with currently available technologies.

VALIDATION/ OUTCOMES ASSESSMENT

Validation of the aided auditory function and questionnaires to measure functional auditory performance based on age, are a critical component of the pediatric amplification-fitting process. Whereas verification serves to ascertain that prescriptively appropriate amplification is provided, outcome assessment checks that amplification meets the needs of an individual child. In the audiology clinic, hearing aids are often validated using developmentally and linguistically appropriate speech-perception materials in an aided sound-field condition. Hearing aids are validated in the home/daycare or school setting by parents/teachers/ early intervention providers using questionnaires. The following table summarizes some assessment tools available for children. As new measures are continually being developed, this is not intended to be an exhaustive list.

1. Parental reports provide a reliable and sensitive method for evaluating alternative gain-frequency responses in hearing aids for children.
2. Outcome assessment should be carried out after introduction of new features in hearing aids.
3. For children older than about 6 years of age, paired-comparisons judgments may be used reliably to identify the optimal frequency response among a small set of alternatives. This assessment method may be more sensitive than speech perception testing, and is useful in identifying the way in which gain-frequency responses may be modified to meet individual needs.

Outcome Assessment Table

Age of Child	Aided Testing	Outcome Assessment/ Questionnaire
Less than 3 years old	Aided audiogram Ling 6 Sounds Test	Parent's Report LittleEARS Infant-Toddler Meaningful Auditory Integration Scale (IT-MAIS) Parents' Evaluation of Aural/ Oral Performance of Children (PEACH) Teachers' Evaluation of Aural/Oral Performance of Children (TEACH)
3-6 years old	Aided audiogram Ling 6 Sounds Test Multisyllabic Lexical Neighborhood Test (MLNT) Lexical Neighborhood Test (LNT)	Children's Home Inventory of Listening Difficulties (CHILD) Meaningful Auditory Integration Scale (MAIS) Parents' Evaluation of Aural/ Oral Performance of Children (PEACH) Teachers' Evaluation of Aural/Oral Performance of Children (TEACH) Screening Instrument for Targeting Educational Risk (Preschool SIFTER)

	Phonetically Balanced Kindergarten (PBK-50) CID-W22 Word Identification by Picture Inventory (WIPI) Pediatric AzBio	
Greater than 6 years old	Aided audiogram Ling 6 Sounds Test Lexical Neighborhood Test (LNT) CID-W22 Pediatric AzBio	Children's Abbreviated Profile of Hearing Aid Benefit (CA-PHAB) Parents' Evaluation of Aural/ Oral Performance of Children (PEACH) Teachers' Evaluation of Aural/Oral Performance of Children (TEACH) Screening Instrument for Targeting Educational Risk (Preschool SIFTER) Listening Inventory for Education (LIFE) Client Oriented Scale of Improvement for Children (COSI-C) Hearing Performance Inventory for Children (HPIC) Self-Evaluation of Listening Function (SELF)

MANAGEMENT/FOLLOW-UP AND REFERRALS

The prescription of hearing aids for children is an on-going, interdisciplinary process. Following the initial diagnosis and hearing aid fitting, continued audiologic evaluation and adjustment of amplification settings based on the updated audiologic data should be prioritized. At a minimum, an audiologist typically sees a child every 3 months during the first 2 years of using amplification and every 4 to 6 months thereafter, with more frequent visits if there are concerns. Children with fluctuating or progressive hearing loss may need more frequent monitoring. Earmolds may need to be replaced every 3 to 4 weeks during the first year of the child's life. Audiologists should continue to provide counseling to support consistent hearing aid use and facilitate understanding of hearing aid care/maintenance. Follow-up appointments include audiologic evaluation to monitor hearing status, periodic assessment of functional measures to document auditory skills, electroacoustic evaluation and listening checks of the hearing aids, re-evaluation of the RECD and other probe-microphone measures as appropriate. RECD are typically re-measured whenever earmolds are replaced.

1. On-going audiologic evaluation- Hearing aid fittings for infants and young children are often based on limited electrophysiological or behavioral data. Children are more likely than adults to experience fluctuation or progression of hearing loss over time, in addition to normal physical growth that can influence the acoustics of the hearing aid fitting and earmold adequacy.
2. Continued social and emotional support- Patient and family should be provided continued social and emotional support as part of routine audiologic follow-up to ensure children, parents, and caregivers have the knowledge and assistance necessary to support consistent use of intervention strategies.
3. Referral for medical evaluations- Referral for medical evaluations is important for identifying potential medical conditions related to the hearing loss, as well as the likelihood for progression or precautions that could minimize likelihood of progressive hearing loss (i.e. limiting participation in contact sports for children with enlarged vestibular aqueduct). Referral to otolaryngology, ophthalmology and medical genetics should be provided for all children who are hard of hearing.
4. Early intervention and academic support- Support for accessing early intervention and academic support should be facilitated, including timely referral to early intervention for infants and young children who are hard of hearing. Educational and academic support also includes supporting Individualized Family Service Plans/Individualized Education Plans (IEP/IFSP), as well as, performing periodic assessments of the child's listening needs to determine candidacy for hearing assistance technology and to optimize use of the technology.

5. Financial support- Resources for financial support and funding to offset the cost of hearing aids should be provided, as concern for the cost of devices is often cited by parents as delaying the initiation of amplification.
6. Support groups- Parent-to-parent support should be offered to families and caregivers of children with hearing loss. Special consideration should be given to matching families based on support needs, hearing loss characteristics and other factors.

USE OF HEARING AIDS WITH OTHER ASSISTIVE TECHNOLOGIES

1. Assistive Listening Devices (ALDs)/ Hearing Assistant Technology (HAT)- The American Academy of Audiology has published clinical practice guidelines (CPG) and verification supplements for hearing assistance technology. These guidelines describe issues surrounding candidacy, personnel, verification, orientation, training, validation procedures and relevant recommendations on these subjects.
2. Cochlear Implants- Each child who receives a cochlear implant in one ear and who has residual hearing in the other ear should be fit with a hearing aid in that ear for providing bilateral stimulation. Children with bilateral hearing impairment require stimulation in both ears for encouraging auditory development and for performing binaural hearing functions. There are binaural benefits when a hearing aid is used with a cochlear implant (bimodal fitting) in the opposite ear.

References

American Academy of Audiology Clinical Practice Guidelines. (2013) Pediatric Amplification. <https://www.audiology.org/sites/default/files/publications/PediatricAmplificationGuidelines.pdf>
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American Speech Language and Hearing Association. Permanent Childhood Hearing Loss <https://www.asha.org/PRPSpecificTopic.aspx?folderid=8589934680§ion=Treatment> Retrieved April 11, 2018