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MINNESOTA EARLY HEARING DETECTION AND INTERVENTION (EHDI) PROGRAM

Guidelines for Pediatric Amplification

Approved May, 2008

Audiologic Assessment Data - see the Minnesota Department of Health Infant Audiologic Assessment guidelines.

Professional and Facility Qualifications for Pediatric Hearing Aid Services

1. A licensed audiologist is the professional singularly qualified to select and fit all forms of amplification for children, including personal hearing aids, FM systems, cochlear implants, and other assistive devices.
2. The audiologist must have experience with the assessment and management of infants and children with hearing loss and the knowledge and test equipment necessary for use with current pediatric hearing assessment methods, hearing aid selection, verification, and validation procedures.
3. Facilities that lack expertise or equipment should establish cooperative arrangements with professionals and facilities that provide pediatric hearing services.
4. All testing, follow-up, and tracking procedures must be consistent with current Minnesota statutory requirements.
5. Audiologists must respect individual family choices. For example, audiologists are obligated to provide unbiased information regarding communication options.

Criteria for Amplification

1. If the child has a permanent, bilateral peripheral hearing loss with thresholds greater than 25dB HL in a portion of the frequency range critical for speech understanding (1000-4000Hz), amplification should be considered and not be delayed for concurrent medical and/or developmental conditions.

2. Ideally, an identified child will be amplified before six months of age, in accordance with the 1-3-6 EHDI model. According to the Joint Committee on Infant Hearing (JCIH, 2007), if families choose to pursue amplification for their infant with hearing loss, the fitting of the amplification device should take place within one month of diagnosis. Hearing aids can be fit on a combination of age-appropriate behavioral and electrophysical results, and hearing-aid fitting should not be delayed.
3. If hearing assessment results were obtained by ABR, frequency specific information must be obtained for appropriately fit amplification (e.g. low frequency (500Hz) and high frequency (4000Hz) tone bursts, more frequencies when possible).
4. If the child has a unilateral hearing loss, with measurable hearing in the affected ear confirmed by ABR and behavioral testing, amplification in this ear may be beneficial. Closely monitored trial use of a hearing aid is suggested during the toddler years. When the ear with unilateral hearing loss is judged to be unaidable, alternative amplification strategies and hearing assistance technologies (HAT), such as FM or Bluetooth systems, should be cautiously considered.
5. If the child has an unusual configuration of loss (e.g., rising configuration loss, precipitous above 2000Hz, cookie bite) or unusual type of hearing loss (e.g., auditory neuropathy/dysynchrony or other central hearing loss), the need for amplification should be made on a case-by-case basis.
6. Chronic or recurrent middle ear conditions can affect hearing thresholds and the effective use of hearing aids. When determining hearing aid candidacy for infants or children, middle ear status must be considered in determining the likelihood of a transient condition. Periodic immittance testing is recommended in all cases of pediatric amplification, using age-appropriate immittance protocols. Infants with chronic middle ear conditions (e.g. otitis media with effusion (OME)) should be referred for medical treatment. However, fitting of amplification and referral to early intervention should not be delayed while waiting for resolution of OME.
7. Infants identified with hearing loss who experience a long hospital stay should be fit with appropriate amplification as soon as medically feasible, after appropriate clearance for amplification use is received from the treating physician.
8. The decision for amplification should be based on the child's audiological data; speech and language development; home-based, center-based, and natural environments; family preferences, and the existence of other medical conditions or special needs. In accordance with Food and Drug Administration regulations, medical clearance must be obtained prior to fitting hearing aids on children.
9. Fitting of amplification should not be delayed for financial reasons such as waiting for insurance to authorize coverage, or certain medical issues such as waiting for middle ear fluid to clear in the presence of sensory hearing loss (pending medical approval). In these situations, appropriate loaner hearing aids may be available through the Lions Loaner Hearing Instrument program. Hearing

aid features and prescriptive settings can and should be modified as information about the infant's hearing levels or status are regularly updated.

Pre-selection - Physical Characteristics

The child needs to be provided with the best amplified speech signal possible.

1. Hearing aids for most children should include the following features:
 - a. options for accessing assistive devices, i.e., direct audio input (DAI), telecoil (T) and microphone-telecoil (M-T) switching option;
 - b. safety features, i.e., tamper resistant battery compartment, volume controls that can be covered or deactivated.
2. Flexibility in setting electroacoustic parameters is critical. Advanced technologies should be considered to meet specific audiologic needs.
3. The physical fit of the hearing aids and earmolds is important for comfort, retention, and acoustic response. Earmolds should be made of soft material for safety and comfort. They should be replaced whenever feedback is excessive at optimal settings or when retention or comfort issues occur. Retention devices include: "Huggies", toupee tape, cords or "Critter clips", headbands, bonnets and caps.
4. Behind-the-ear (BTE) hearing aids are the optimal style for most children. Providing the best possible amplified speech signal should not be compromised for cosmetic purposes. In-the-ear (ITE) and completely in the canal (CIC) hearing aids are not recommended for use with infants and young children due to the small size and rapid growth of the outer ear.
5. Binaural amplification should always be provided to young children unless there is behavioral evidence that a hearing aid fitted on the poorer ear is detrimental to performance.
6. The audiologist should ensure that the hearing aids are covered for loss and damage.
7. A bone conduction aid may be appropriate if the loss is conductive and BTEs cannot be used due to medical or physical contraindications. A bone anchored (surgically implanted) hearing aid may be appropriate for some children on a case by case basis.
8. The JCIH 2007 guidelines advises against the use of CROS/BICROS hearing aids for children with unilateral hearing loss.
9. Non-traditional amplification (i.e., frequency transposition/frequency compression hearing aids) may be appropriate for children with substantial (> 60dBHL) high frequency hearing loss. Use of these non-traditional hearing aids should be determined on an individual basis.

10. FM systems and similar wireless assistive technologies should be considered when the child becomes more mobile and needs to listen to a caregiver at greater distances, to improve signal-to-noise ratio, or when increased signal strength is desired to improve audibility of speech, i.e., in cases of severe or profound hearing loss. FM and comparable technologies are the systems of choice to reduce the negative effects of background noise, distance from the talker and high reverberation levels
11. Young children need to hear environmental sounds and speech from all directions to maximize development of auditory, language, and speech skills. Therefore, directional microphones should be used judiciously with young children, and is not recommended for infants. However, this hearing instrument feature may be considered on an individual basis to improve signal-to-noise ratio. Advanced adaptive directionality combined with low compression knee-points and speech-enhancement algorithms may preserve audibility for speech when background noise is present.
12. A cochlear implant may be considered for children who gain limited benefits from amplification. Any family considering cochlear implantation should consult with their audiologist and a cochlear implant center to determine candidacy.

Selection and Verification of Electroacoustic Characteristics

The use of a systematic approach when selecting electroacoustic characteristics of hearing aids for children is considered of utmost importance.

1. The Desired Sensation Level (DSL) Method (most current platform) is the approach of choice for infants and children, calculated manually or available in computer assisted format from the University of Western Ontario at <http://www.dslio.com/>, and also incorporated as a target selection in some hearing instrument electroacoustic analysis systems. This method considers the individual infant's hearing loss, real-ear measures and acoustics of the ear canal.
2. Amplification should be fit based on appropriately converted ABR thresholds or on behavioral thresholds. ABR assessment results should be clearly marked as to whether or not they have been converted.
3. Probe microphone measurements should be used when possible to determine the correction from 2cc coupler to real-ear (RECD) for the individual child. At a minimum, new RECD measures should be completed when new earmolds are fit.
4. If current measured RECDs cannot be obtained, published age-norms for average RECD (real-ear-to-coupler average age-related transformation values) should be used to predict performance. (The Pediatric Working Group, 1996, Table 3).
5. Options for determining and verifying output-limiting levels include:
 - a. direct real-ear measurement (REM) of the saturation response (RESR) for each ear;

- b. use of measured or average age-related RECD values along with the calculated desired SPL values (The Pediatric Working Group, 1996, Table 2);
 - c. simulated real-ear measurement (S-REM) of the saturation response.
 - d. frequency-specific loudness discomfort levels in each ear should be obtained on children capable of providing reliable responses.
6. Prior to direct evaluation of the hearing aid on the child, the hearing aid should be preset in a hearing aid test box or real-ear simulator to verify that specified targets are met using the child's RECD.
 7. Real-ear or simulated real-ear verification of the hearing aid response should be obtained for average, soft and loud speech stimuli. A computer program (SHARP) is available from Boystown Hospital (http://www.boystownhospital.org/Research/Areas/ClinicalBehavioral/situational_aid.asp) which can provide information to parents, educators, and therapists on signal audibility under typical listening conditions. The free program computes Aided Audibility Index (AAI), a numerical value that allows a relative comparison of audibility across listening conditions and hearing aid settings
 8. Continued observation and re-assessment of the child's hearing levels should be completed at regular intervals. See follow-up.
 9. Family education regarding use and care of the hearing aid(s).

Validation of Aided Auditory Function

The child's own speech and that of others should be audible, comfortable, and clear.

1. Validation is ongoing and accomplished through use of the following:
 - a. Speech, language, and communication assessments obtained during the habilitation process. Parents, audiologists and early intervention providers should be in regular communication with one another about the child's progress and any need for amplification fine-tuning.
 - b. Direct measurements of the child's performance in clinical and natural environments may include:
 - 1) aided soundfield responses to various stimuli, including aided Speech Awareness or Speech Reception Thresholds;
 - 2) aided speech perception measures, e.g., Ling sounds spoken from various distances, NU-CHIPS, WIPI, PB-K words as child becomes older;
 - 3) parent report measures, e.g., Infant-Toddler: Meaningful Auditory Integration Scale (IT-MAIS) (Zimmerman-

Philips,1997), Developmental Index of Audition and Listening (DIAL).

2. Validation measures should be obtained in a binaural presentation mode unless the intent of the assessment is to document asymmetry in aided performance.
3. Validation should also include other assistive listening devices used in the child's habilitation (e.g. FM systems).

Follow-up

1. Periodic audiological re-evaluations are essential: recheck 1 month following initial fitting, and at 2-3 month intervals thereafter for the first year of amplification; every 4-6 months until age 5, and yearly thereafter. The frequency of follow-up may need to be increased if fluctuation/progression of the hearing loss is noted and/or if progress is not as expected.
2. Earmolds should be checked and remade as necessary, often every 2-3 months during periods of rapid growth.
3. Hearing aid re-checks should include regular coupler and real-ear measures of performance. When a hearing aid needs to be sent for repair, the child should have access to a loaner hearing aid.
4. Audiologists and families should communicate at each visit to answer questions regarding care and use of amplification devices. Regular communication is also necessary at each visit to ensure that appropriate referrals continue to be made and that the family is receiving desired services.
5. Ongoing communication between the clinical audiologist, the family, the members of the early intervention team and the medical home is critical. A written care plan/action plan is recommended for optimal communication success.
6. Family support and counseling is ongoing. Families should be referred to MN Hands and Voices.

Acknowledgement

Portions of this document were adapted from The Pediatric Working Group of the Conference on Amplification for Children with Auditory Deficits, (1996), Amplification for Infants and Children with Hearing Loss, *American Journal of Audiology*, 5 (1), 53-68.

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