



Habilitation Outreach for
Professionals in Education

HOPE Note

Auditory Skill Development



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Auditory performance with a cochlear implant can be described using four broad categories of auditory skill. In younger children, development of auditory skills occurs in a more naturalistic fashion in which all skills are targeted simultaneously. For older children development of auditory skills may be more linear and systematic. The following HOPE Note provides information on the hierarchy of auditory skill development that is essential for assessing current ability, targeting intervention goals and providing habilitation to children with cochlear implants.

A number of researchers and interventionists have proposed models of auditory skill development. While there may be some differences between and among models, it may be sufficient to consider five major stages of auditory skills development for children who use implants.

- **Detecting** or hearing a sound without knowing what made the sound or what it means. This is generally the first listening behavior observed after implantation.
- **Patterning** or differentiating between sounds based on the patterns of those sounds. For example, a child may be able to tell the difference between sounds that are long versus those that are short or a one-syllable word versus a polysyllabic word.
- **Discriminating** or determining if two auditory stimuli are the same or different. This auditory skill is

not one specifically designated for instruction, rather it is used as a tool to compare and contrast listening targets.

- **Identifying** or repeating what has been heard or selecting a word from a group of choices. This listening skill is supported by a good vocabulary and language base.
- **Comprehending** or processing spoken language and responding to it appropriately. For example, a child who answers a question through listening alone is demonstrating auditory comprehension.

Acquiring Auditory Skills

One may view the development of auditory skill from either of two perspectives: a top down, wholistic perspective or a bottom-up, building block perspective.

Top-Down Approach: Considered the more naturalistic of the two perspectives, listening skills are both the process and the product of easy communication between young child and caregiver. Auditory access provided by the cochlear implant gives young, severely to profoundly deaf children the greatest potential to develop auditory skills in a naturalistic, but facilitated manner. This most parallels skill development in hearing children in which auditory skills (and the language development that follows from their



acquisition) are facilitated but not specifically taught. Input by the adult caregiver or speech and hearing professional is abundant and purposeful; the child absorbs language through listening as part of overall cognitive development.

Bottom-Up Approach: Children who are somewhat older and/or who have learning challenges in addition to deafness may benefit from more directed listening experiences in which specific auditory skills are introduced and practiced until mastered. This is no less a path to auditory comprehension, but it generally requires more detailed planning and systematic presentation to the child. The rate at which a child develops auditory skills will depend on a number of factors, some of which are within the control of the school-based professional while others are not. Some children benefit from a period of directed listening early on in the process and transition to more natural skill development once auditory access has been “jump started.”

Language and Listening

There is a complex relationship between listening and language such that advanced auditory skills may be observed in the context of simplistic language, and complex language forms will dictate a return to previously acquired auditory skills. In some circumstances, the development of auditory skills is hampered by limitations in vocabulary and incomplete language learning that occurred prior to implantation. When this is the case, as in older children receiving implants, it is incumbent upon the speech and hearing professional to monitor absolute auditory skill development (using assessments that take a child’s language ability into account) in order to determine auditory progress with the device. Regardless, the interventionist will work toward moving auditory skills along a continuum with the ultimate goal of having audition contribute to subsequent language learning.

Related Resources

Caleffe-Schenck, N. (2006). *An Auditory Approach: Focus on Children with Bilateral Cochlear Implants*. HOPE Online Library. Available at www.cochlear.com/HOPE.

Cochlear Americas. (2005). *Getting Started--For Pediatrics featuring Nancy Caleffe-Schenck* (FUK 054) (CD-Rom, Free). To order, call Cochlear Americas 800.523.5798 and ask for Customer Service.

Chute, P., & Nevins, M.E. (2006). *Developing Auditory Skills: Thinking Outside the Box in School Professionals Working with Children with Cochlear Implants*. San Diego: Plural Publications.

Erber, N. (1982). *Auditory Training*, Washington D.C.: AG Bell Publications.

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Spoken Language Development

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The benchmarks for spoken language development with the cochlear implant are of particular interest to speech language pathologists and teachers of deaf children. The following HOPE Note outlines general expectations for language development in light of cochlear implantation.

For children with hearing in the normal range, spoken language development begins in earnest on the first day of life. That is when they are first introduced to their parents' voices and the sounds and words all around them. As their auditory skills, vocal skills and cognitive skills develop, they are able to attach meaning to the sounds that they are hearing and then reproduce those sounds to convey meaning on their own. The child with hearing loss, however, does not have access to all of the sounds of spoken language and is less able then, to connect the objects and actions that are seen to the spoken words that represent them. Because hearing aids often do not provide all of the acoustic features necessary to distinguish one sound or word from another, even the child that wears hearing aids receives inconsistent and/or incomplete messages.

Factors the Influence Spoken Language Development

Almost immediately upon activation, the cochlear implant affords the user access to all of the sounds of speech. Progress in spoken language development is therefore dependent on a number of factors. These may include:

- Age at implantation/duration of deafness - The younger the child when he receives a cochlear implant, the greater his potential for developing normal spoken language skills.
- Aided benefit prior to implantation - The greater the benefit of hearing aids prior to cochlear implantation, the greater the child's potential for developing normal spoken language skills.
- Co-occurrence of other developmental issues (e.g. developmental delay, motor impairments) - Children with hearing loss may have other challenges, in addition to or aside from their hearing loss, which will compromise their progress with spoken language development.
- Level of family involvement and expertise of educational professionals in maximizing the cochlear implant's potential - Spoken language will develop most rapidly when it is facilitated through a focus on the development of auditory skills.

Normal Development as a Reference

When the end goal for a child with an implant is the development of age appropriate spoken language, an approach that pairs auditory stimuli (sounds and words) with related objects and actions will allow the child to assign meaning to sound in the same way that a hearing child would.





Parents and professionals must have patience through the early stages of auditory awareness in which children primarily take in sounds rather than producing them. By recognizing that this normal developmental sequence of auditory growth and language development applies equally to children that have recently received implants, parents and early interventionists may be more committed to provide input even when there is no immediate expressive response to their efforts.

Milestones of Development.

In general child with a cochlear implant may be expected to display the following stages of spoken language development:

- An initial period marked by decreased vocalizations while taking in new auditory stimuli.
- A babbling stage in which the child plays with his voice and articulators.
- Understanding and use of sound/object associations and inflected utterances (e.g. “meow” for cat, or “uh-oh”) where suprasegmentals and early vowel/consonants are highlighted.
- A period of using single words and jargon (single words embedded into babble sounds that mimic conversational speech inflections) along with some learned phrases.
- The combination of known words into novel phrases.

The ultimate goal for children with hearing loss is that they will begin to learn spoken language at the same rate as their hearing peers. This typical rate of growth is judged to be “one year’s progress in one year’s time” Children that receive cochlear implants at a young age have the potential to achieve this rate of language growth and may, in fact, catch up to their hearing peers so that they have comparable spoken language skills. Spoken language competence sets the stage for continued social, emotional, and educational growth.

Related Resources

Cole, E. (1992). *Listening and Talking: A Guide to Promoting Spoken Language in Young Hearing Impaired Children*. Washington D.C.: AG Bell Publications.

Estabrooks, W. (1998). *Cochlear Implants for Kids*. Washington D.C.: AG Bell Publications.

Madell, J. (2006). *Maximizing Listening and Learning*. HOPE Online Library. Available at www.cochlear.com/HOPE.

Moog, J., et al. (2004). *Teaching Activities for Children who are Deaf and Hard of Hearing: A Practical Guide for Teachers*. St. Louis: Moog Center. Available through publications@moogcenter.org.

Owens, R. (1996). *Language Development: An Introduction* (4th ed). Needham, MA: Allyn & Bacon.

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Performance Outcomes

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Assessing performance outcomes of a child with a cochlear implant is closely linked to candidacy factors such as age at implantation. The following HOPE Note outlines the general performance trends observed in children with cochlear implants over time.

Performance Trends

Just as there is a variety in the general population on measures of performance, so too is there variability in performance of children with cochlear implants. That being said, however, in the almost twenty years of experience with children with cochlear implants, certain trends with regard to implant usage have emerged. First, children who receive cochlear implants at early ages (two years of age or younger) appear to have great potential for maximizing the benefit offered by implant technology. Older children, with short durations of deafness (e.g. those who were hard of hearing and then had a decrease in hearing) also appear to maximize the implant's potential. In contrast, children with long durations of deafness, implanted at later ages receive more limited benefit from the device. Finally, medical, cognitive or environmental issues present at the time of candidacy evaluation will affect performance outcomes after implantation. Regardless, under the right conditions (good maintenance and proper habilitation) benefit from the device can still be anticipated for virtually all children that seek implantation.

Successful Use of the Cochlear Implant

It is commonly accepted in cases of severe and profound deafness that the auditory access provided by a cochlear implant is superior to that of hearing aids. Thus, it is likely that the majority of children that receive cochlear implants will, at minimum, develop auditory skills beyond those that would have been possible with a hearing aid. Any given child's performance with a cochlear implant cannot be predicted. However, systematic development of auditory skills should be expected over time unless there are mitigating circumstances that preclude maximal use of the potential of the device. Examples of these mitigating circumstances include limited cognitive ability or language processing issues. On one end of the performance continuum are children who develop comprehension of spoken language such that they can participate easily and respond appropriately in conversational exchanges. Other children will need contextual support to process spoken language yet they will receive much important information auditorily. Still others will benefit from the implant primarily as an assist to visual communication. Regardless of absolute performance level, children who wear their implants for all waking hours will receive their own benefit from the device and can be considered successful users.





Responsibilities of Educational Professionals

School based professionals with knowledge about anticipated performance outcomes of children with cochlear implants will be positioned to monitor progress to determine if appropriate levels of auditory achievement are being met. Conversely, these same professionals can establish whether or not a given child's level of performance matches appropriate expectations based on the pre-implant profile. When a given child's performance is substandard with regard to expected auditory accomplishments, it is incumbent upon the teacher or speech and language pathologist to initiate additional assessments, revise the intervention plan and/or pursue additional resources as needed.

Related Resources

Brooks, B.M. (2002). *My Baby and Me - A Book About Teaching Your Child to Talk*. St. Louis: Moog Center for Deaf Education.

Chute, P., & Nevins, M.E. (2006). *The Zone of Cochlear Implant Performance in School Professionals Working with Children with Cochlear Implants*. San Diego: Plural Publications.

Cochlear Americas. (2004). *(Re)Habilitation Factors in Cochlear Implant Resource Guide*. Englewood, CO. To order, visit the HOPE Education and Rehab section of the Cochlear Online Store: www.cochlear.com/shop.

McClatchie, A., & Therres, M.K. (2003). Educational Outcomes and Support Services in *AuSpLan: Auditory, Speech and Language. A Manual for Professionals Working with Children Who Have Cochlear Implants or Amplification*. Children's Hospital and Research Center at Oakland. Available at www.agsbell.org.

Nevins, M.E., & Garber, A.S. (2005). *Benchmarks of Performance for Children with Cochlear Implants*. HOPE Online Library. Available at www.cochlear.com/HOPE.

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HOPE Note

The Newly Implanted Infant/Toddler



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Children may now receive a cochlear implant as early as 12 months of age. Implantation at this early age affords a child an excellent opportunity for developing spoken language abilities comparable to same-age peers, but requires that habilitation begins early as well. The following HOPE Note addresses considerations for designing a comprehensive intervention plan for newly implanted infants and toddlers.

Of the many variables affecting anticipated performance with a cochlear implant, length of deafness can be considered one of the most influential. When a child receives an implant at 12 months of age, this period of deafness is minimized, giving the recipient excellent potential for developing spoken language. Often, infants and toddlers that receive cochlear implants begin to exhibit spoken language development that allows them to catch up to their hearing peers within one to two years. This rate of progress depends, however, on the implementation of a comprehensive parent-centered habilitation plan.

Parents as Teachers

Best practices models of early intervention services have called for parent-centered services for many years. In no circumstance is this more critical than with the newly implanted child. Professionals serving these children must assist families in maximizing the benefits of the cochlear implant by

modeling appropriate techniques to stimulate auditory and language skill development. More importantly, allowing families opportunities to practice these skills immediately will best serve to insure carry-over. Professionals should take care to demonstrate specific strategies for achieving auditory and language goals so that parents have clear guidelines for home practice between visits. Ultimately, it is the time that parents spend with their children that will have the most effect on a child's auditory and language skill development.

Normal Development Model

When developing intervention strategies for young children with cochlear implants, the professional can feel confident that his or her knowledge of normal language development is the best reference for setting auditory and spoken language goals. Children that receive implants at a young age have been found to acquire speech and spoken language benchmarks in much the same sequence as children with normal hearing. Babbling and vocal play are noted as children become auditorily aware of their voices, jabbering is observed as children identify rhythms and intonation of conversation, and words develop as children match labels and phrases with experiences and objects. By using a



developmental model as a guide, the educational professional can easily pair auditory stimuli with developmentally appropriate toys and activities to achieve spoken language goals.

A Naturalistic Approach

Above all, cochlear implant habilitation for very young children must utilize a naturalistic approach to be most effective. Children, and their parents, will find habilitation activities more meaningful and easier to duplicate when real-life situations are used as models and familiar household routines and artifacts are used as stimuli. The right games will set the stage for developmentally appropriate imitation and turn-taking skills, vocabulary, and babble. A naturalistic approach also builds on routine activities and recurring events so that children can anticipate language and auditory stimuli. Such an approach discourages the didactic introduction of auditory goals one by one, but rather encourages the professional to highlight various auditory and language targets simultaneously. For example spilling juice on the table can incorporate vocal inflection, patterned phrases, and concepts all at once: "Uh - Oh! What a mess! So dirty! Let's wash, wash, wash the table." It is the power of the cochlear implant, providing access to all spoken language, which allows for this naturalistic approach. While auditory function will develop from the most basic skill (detecting) to the most advanced (comprehending), input for children at young ages should be varied to include all linguistic elements (sounds to conversation and conversation to sound) to be most effective.

Related Resources

Brooks, B.M. (2002). *My Baby and Me - A Book About Teaching Your Child to Talk*. Moog Center for Deaf Education. St. Louis.

Cochlear Americas. (2005). *Getting Started—For Pediatrics* featuring Nancy Caleffe-Schenck (FUK 054) (CD-Rom, Free). To order, call Cochlear Americas 800.523.5798 and ask for Customer Service.

Cochlear Ltd. (2003). *Jacob's Journey*. Australia. To order, visit the HOPE Education and Rehab section of the Cochlear Online Store: www.cochlear.com/shop.

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Cole, E. (1992). *Listening and Talking: A Guide to Promoting Spoken Language in Young Hearing-impaired Children*. Washington, DC: AG Bell Publications.

Pollack, D., Goldberg, D., & Caleffe-Schenck, N. (1997). *Educational Audiology for the Limited Hearing Infant and Preschooler: An Auditory-Verbal Program* (3rd ed.). Springfield, IL: Charles C. Thomas.

Robbins, A.M. (2003). *Communication Intervention for Infants and Toddlers with Cochlear Implants*. *Topics in Language Disorders*. 23,16-33.

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HOPE Note

The Newly Implanted Preschooler



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While cochlear implantation is available for children as young as 12 months of age, some children receive implants at a later time. These children have an excellent opportunity to catch up to their hearing peers, especially if they receive a habilitation program that takes into account their auditory and language experiences prior to implantation. The following HOPE Note addresses considerations for designing a comprehensive intervention plan for newly implanted preschool aged children.

Among the many variables affecting anticipated performance with a cochlear implant, length of deafness can be considered to be one of the most influential. Children that receive cochlear implants in the preschool years, ages 3 to 5, have experienced an extended period of deafness that challenges their development of spoken language skills, but does not preclude it. Because the preschool aged implant recipient may have had more visual than auditory access to the world as a way to catalogue previous experience and learning, the task of speech and hearing professional is three-fold: developing listening skills for accruing new information auditorily, creating links to information stored previously as visual input, and overlaying structured listening tasks with a naturalistic approach to auditory and language skill development as quickly as possible.

Developing Auditory Skills

It is generally recommended that young children who receive cochlear implants have the opportunity to develop

listening skills in naturalistic exchanges in a manner that follows auditory development in hearing youngsters. As their length of deafness increases, however, this natural approach must be supplemented by a more systematic development of listening skills.

Because **detection** of speech and environmental sounds is one of the immediate outcomes of implantation, there is no need to "train" this rudimentary skill. The interventionist will want to make links between new auditory perceptions and the child's knowledge base. If a child alerts to a sound, it should be identified.... "That's an airplane, I hear it too!" In this way, sound awareness is reinforced, rather than individually targeted. **Pattern perception** is an auditory skill that allows a child to differentiate between sounds, words, and sentences based on suprasegmental cues such as duration, syllable number or sentence length. This is a skill that can be readily observed after implantation and the speech and hearing professional can use a child's existing vocabulary and language base to develop this ability. Age appropriate listening games and activities are recommended for this type of skill development especially when content or theme based classroom materials are incorporated. Nursery rhymes and fingerplays are excellent tools for developing patterning skills for the preschool aged cochlear implant recipient.

The auditory skill of **segmental identification** requires that the child

Hear now. And always



hear more than patterns of syllables or intonation. For the preschooler using a cochlear implant, utilizing Learning to Listen Sounds (see Estabrooks reference) for familiar objects and actions may be one technique for bridging to real word usage by combining suprasegmental and segmental features that provide optimum contrast between words. These Learning to Listen Sounds can also offer the young child opportunities for vocal play that are developmentally appropriate given the child's hearing age.

The highest level of auditory skill, **auditory comprehension**, demonstrates that the child can process and respond to information presented through listening only. Children should be encouraged to use listening for comprehension especially in routine situations in which the context and form of the language are known to the child. Encouragement for functional listening at all levels of auditory skill development will serve to reinforce the utility of listening in gaining information about the world. Pretend play activities such as having a tea party or giving baby a bath, are excellent vehicles for expanding functional listening skills into natural language contexts.

A Developmental Model

When developing lesson plans for young children with cochlear implants, the educational professional can feel confident that his or her knowledge of normal language development is the best pattern for setting auditory and spoken language goals. Children that receive implants at young ages have been found to acquire speech and spoken language benchmarks in much the same sequence as children with normal hearing. Just as with a younger child, babbling and vocal play are noted as children become auditorily aware of their voices, jabbering is observed as children identify rhythms and intonation of conversation and songs and words develop as children match words and phrases with experiences and objects. By using a developmental model as a guide, the educational professional can easily pair auditory stimuli with age appropriate toys and activities to achieve spoken language goals both in natural and structured settings. The opportunity to infuse listening into classroom themes and vice versa is ever present.

Links to Information Acquired Prior to Implantation

The school-based professional will not want to overlook the store of world and language knowledge that the child acquired before implantation. While it is not recommended

that systematic transfer of visual language and world knowledge to an auditory representation be undertaken, there is utility in helping create listening links to previously acquired speech, language and world knowledge. This may be best accomplished in the preschool classroom combined with one-on-one intervention including parent demonstration as often as possible. In this way, new auditory skills can be developed and practiced in the context of familiar vocabulary, language and content. Conversely, acquired auditory skills may be practiced when introducing new themes. As the child becomes successful, generalizations to information gathering through audition may be facilitated.

Related Resources

Cochlear Americas. (2005). *Getting Started—For Pediatrics* featuring Nancy Caleffe-Schenck (FUK 054) (CD-Rom, Free). To order, call Cochlear Americas 800.523.5798 and ask for Customer Service.

Cochlear Ltd. (2003). *Listen Learn and Talk*, Tapes 2 and 3: "Toddlers Talk" and "Children Chatter". Australia. To order, visit the HOPE Education and Rehab section of the Cochlear Online Store: www.cochlear.com/shop.

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HOPE Note

The Newly Implanted School-Age Child



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Children may enter the implant process at any time after 12 months of age. Those implant candidates who present during the “school-age years”, between approximately 5 and 12 years old, will need habilitation that takes into account their auditory and language experiences prior to implantation. The following HOPE Note addresses the need for individualization in designing intervention for newly implanted, school-age children.

The positive effects of early intervention for children with hearing loss have been well documented. When a child receives an implant after age 5, he/she is beyond the early intervention window but still has the potential to receive material benefit from the device. Before designing an auditory habilitation plan for that child, a number of questions must be answered. These include:

- At what age was the hearing loss identified?
- Was the child’s hearing loss progressive?
- What were the child’s auditory experiences prior to implantation?
- How does the child’s Language Age compare to Chronological Age?

Some school-age implant recipients may have had more visual than auditory access to the world and used this as a way to

catalogue previous experience and learning. Thus, the task of speech and hearing professional is two fold: developing listening skills for accruing new information auditorily and creating links to information stored previously as visual input (e.g speech-reading).

Developing Auditory Skills

It is generally recommended that young children who receive cochlear implants have the opportunity to develop listening skills in naturalistic exchanges in a manner that follows auditory development in hearing youngsters. Older children, however, already have percepts and experiences that can contribute to a more systematic development of listening skills. Because **detection** of speech and environmental sounds is one of the immediate outcomes of implantation, there is no need to “train” this rudimentary skill. The interventionist will want to make links between new auditory perceptions and the child’s knowledge base. For example, if a child alerts to a sound, it should be identified....“People are walking in the hall and you can hear them talking.” Sound awareness is reinforced, but not specifically targeted. **Pattern perception** is an auditory ability that allows a child to distinguish between sounds, words, and sentences based on suprasegmental cues such as duration, syllable number or sentence length. This is a skill that develops quickly after implantation; the speech and hearing professional

can use a child's existing vocabulary and language base to develop it. Age appropriate listening games and activities are recommended for pattern perception especially when content or theme-based classroom materials are incorporated.

The auditory skill of **segmental identification** requires that the child hear more than patterns of sounds. It is often the powerful vowel sounds that a child begins to attend to in order to differentiate between the words "backpack" and "lunchbox." Familiar vocabulary usage is particularly "friendly" when introducing and practicing this skill with the newly implanted school-aged child. Children at the level of segmental identification may spend some time working within these two levels of auditory skill, especially as language complexity and familiarity is manipulated within a skill level.

The highest level of auditory skill, **auditory comprehension**, requires that the child process and respond to information presented through listening only. Children, who respond to auditory input once access is provided by the implant, should be encouraged to use listening for comprehension. This may first be expected in routine situations in which the context and form of the language are known to the child. Encouragement for functional listening at all levels of auditory skill development will serve to reinforce the utility of listening in gaining information about the world.

Creating Links to Information Acquired Prior to Implantation

The school-based professional will not want to overlook the store of world and language knowledge that the child acquired before implantation. While it is not recommended that systematic transfer of visual language and world knowledge to an auditory representation be undertaken, there is utility in helping create listening links to previously acquired speech, language and world knowledge. This may be best accomplished in one-on-one intervention settings; new auditory skills can be developed and practiced in the context of familiar vocabulary, language and content. Conversely, *acquired* auditory skills may be practiced when introducing new themes. As the child becomes successful, generalizations to information gathering through audition may be facilitated.

High, but Realistic, Expectations

The single most important goal for the school-based professional working with a newly implanted school-age child is to foster

feelings of success with the device. Since early accomplishment begets later success, it is incumbent upon the interventionist to design activities and tasks that will allow the child to realize auditory benefit from the implant at any of the skill levels at which the journey begins. The knowledgeable professional should set realistic expectations, but at the same time, be open to reaching greater levels of performance for a child in light of the new auditory access afforded by cochlear implant technology.

Related Resources

AVLI Learning Series. *Hearing Is Believing!* Volume 1 presented by Dimity Dornan. Available at www.avli.org.

Chute, P., & Nevins, M.E. (2006). *School Professionals Working with Children with Cochlear Implants*. San Diego: Plural Publications.

Cochlear Americas. (2003). *Listen Learn and Talk*, Tape 3: "Children Chatter". Englewood, CO. To order, visit the HOPE Education and Rehab section of the Cochlear Online Store: www.cochlear.com/shop.

DeConde Johnson, C., Benson, P., & Seaton, J. (1997). *Educational Audiology Handbook*. Florence KY: Thomson Delmar Learning.

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HOPE Note

The Newly Implanted Teenager



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HOPE Specialists

Improvements in implant hardware have resulted in ear level devices that are cosmetically more appealing to adolescents than they were ten years ago. Thus, more and more teens are considering implantation; there are a number of distinctly different teenage groups who seek implantation. The following HOPE Note will identify those groups and make recommendations for intervention that is both age appropriate and commensurate with presenting skill levels.

Adolescents with Decrements in Hearing Level

For teenagers who have had prelinguistic mild to moderate hearing loss, the onset of puberty sometimes triggers a precipitous drop in hearing levels. Teens who have successfully learned spoken language through their hearing aids are often frustrated and may be despondent after the sudden change in hearing status. These adolescents often make excellent use of a cochlear implant because of their prior experience in listening and language. However, a period of adjustment to sound that is electrical (through the cochlear implant) versus mechanical (through hearing aids) is required. Implant candidates who present with this profile will need support and encouragement to persevere with the new signal. Communicating with other teens who have successfully negotiated the transition from hearing aids to implants is important. Systematic successes

with listening through the implant will serve as motivation for continuing a commitment to its use. Speech and hearing professionals will want to ensure that any auditory activity that is undertaken is of high interest to the teen: music, humor, sports and television may all be considered appropriate materials for listening practice.

Adolescents with Severe Hearing Loss and Prior Listening Experience

Changing audiologic criteria for implantation has created interest in the device for some adolescents previously ineligible for the implant to reconsider candidacy in the teenage years. These students were successful hearing aid users, but often performed less well in functional listening environments, than under ideal testing conditions. Implantation for this group often results in improved high frequency hearing, which contributes to better functional speech perception in everyday listening situations. The presenting language ability of the student will influence the type of materials that are appropriate for practicing listening skills with the implant. Providing auditory opportunities that particularly emphasize the advantage of high frequency hearing may yield good outcomes early in the process. A more analytic approach to skill development may benefit these youngsters; the degree of their language



sophistication will influence just what form these listening activities may take. A procedure called “Continuous Discourse Tracking” may offer some appeal for these teens (see DeFillipo and Scott reference) as might online listening programs that target minimal pair listening contrasts.

Adolescents with Limited Auditory and Linguistic Experience

Parents of adolescent children with limited auditory experience or linguistic development continue to choose implantation in an effort to provide greater opportunities for the future. When teenagers come to the implant process with only narrow experiences to contribute to their use of the device, more basic auditory skills will need to be targeted. Intervention with these teenagers must be relevant and immediately gratifying in order to motivate them to persevere. Practical auditory tasks such as differentiating between the length of two common, spoken messages may set the stage for the functional use of listening in the real world. Small successes should be recognized and reinforced. Because better speech is usually a desire of many in this teenage group, intensive and systematic work on a reasonable number of key words and phrases may be in order. Practicing those targets in real world communication settings may yield sufficient outcomes to encourage the continued development of new listening skills and the speech skills, albeit limited, which may arise from auditory access.

Related Resources

American English Pronunciation Practice: www.manythings.org.

Cochlear Americas. (2004). *Hear We Go! A Rehabilitation Resource for Teenagers* (CD format). Englewood, CO. To order, visit the HOPE Education and Rehab section of the Cochlear Online Store: www.cochlear.com/shop.

Cochlear Ltd. (2004). *Sound and Beyond*. (CD format). Australia. To order, visit the HOPE Education and Rehab section of the Cochlear Online Store: www.cochlear.com/shop.

Duncan, J. (2005). Making Sense of Complex Skills Lesson Planning. *The Listener: Journal of the Learning to Listen Foundation*. pp 99-107.

DeFillipo, C., & Scott, B. (1978). A method for training and evaluating the reception of ongoing speech. *Journal of the Acoustical Society of America*. 63, 1186-1192.

Nevins, M.E., & Garber, A.S. (2006). *Teens: A Whole 'Nother World*. HOPE Online Library. Available at www.cochlear.com/HOPE.

Tye-Murray, N. (1997). *Communication Training for Older Teenagers and Adults: Listening, Speechreading and Using Conversational Strategies*. Washington, DC: AG Bell Publications.

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Habilitation Outreach for
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HOPE Note

Assessment Measures



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HOPE Specialists

Each professional involved in cochlear implantation uses tests specific to his/her own area of study to assess the progress of a particular child. The following HOPE Note outlines and compares the range of evaluation measures that are used to assess progress for children with cochlear implants.

Speech Perception Measures

Audiologists may use a series of tests designed to quantify the ways in which a child's perception of speech has changed, both to determine the child's candidacy for an implant and to assess progress with the device. These tests examine the following parameters:

- **Detection/Awareness**
The child's ability to determine the presence of sound
- **Pattern Perception**
The child's ability to notice changes in pitch, duration (long/short) or intensity (quiet/soft) of a series of sounds
- **Discrimination**
The child's ability to determine if two auditory stimuli are the same or different
- **Identification/Recognition**
The child's ability to identify the auditory stimuli by naming or pointing to a corresponding picture/toy
- **Comprehension**
The child's understanding of auditory information

Identification and Comprehension tasks can be performed in a variety of ways that change the difficulty of the task:

- **Closed Set tasks:** a limited number of choices is provided
- **Open Set tasks:** no limit is given to the field of information from which the stimulus is pulled
- **Live voice:** the examiner gives the test using his/her own voice
- **Recorded voice:** taped or recorded speech is used to deliver the stimuli

Speech perception tests are scored on a percentage basis: the number of correct responses divided by the total number of responses. These tests are not normed on populations of children, therefore do not allow for comparison of a child's score to scores achieved by particular groups. The tests are used to compare a child's performance to his/her past performance on the same measure, thereby giving an indication of progress.

It is important to note that auditory skills are only the building blocks for spoken language communication. Increasing skill noted by speech perception measures, while encouraging, does not give the full picture of a child's communication ability. Language measures will add important information to that composite.

Language Measures

Speech-language pathologists use a variety of different assessment tools to evaluate a child's comprehension of various aspects of language and his or her use of language skills to communicate. The following areas of language may be tested individually or in conjunction with other skills:

- Vocabulary – a child's knowledge store of words and their meanings
- Syntax – the formation of sentences (grammar)
- Morphology – the formation of word endings to create meaning (grammar)
- Pragmatics – the use of language to convey social meaning or intention

For each of the above parameters, a child's comprehension or understanding (receptive language) will be assessed as well as use or expression (expressive language) of those same features. Language tests will often be highly structured in administration, although observation of a child communicating naturally (language sampling) will be included in the most comprehensive of assessments.

Most language measures for children above the age of 3 are norm-referenced tests – those that have been standardized on a group of children with certain characteristics. When these tests are used, a given child's performance can be compared to that of the tested population. For children using cochlear implants, for example, a particular child's test performance could be compared to that of hearing children of the same age. Additionally, scores from a particular test repeated over time can be compared to determine both the child's own progress and his progress compared to that of the group.

Speech Production Measures

Speech language pathologists also use a variety of tests to assess speech productions skills. These are typically tasks that require a child to name a given picture with pictures chosen to stimulate production of the various sounds in English. The professional then assesses each response as to the clarity of the sound production. Speech production measures have various scoring procedures, all based on the comparison of a child's production of sounds to the developmental expectation for sound acquisition. A child's audiogram and his/her hearing age must be considered in order to determine appropriate expectations for correct sound production. In addition, overall clarity of speech may be assessed through measures of speech intelligibility.

Using Test Scores

Making functional use of test scores on reports provided by other professionals can often be challenging for the school-based professional. Test scores are best used when the context of each test is understood, therefore requesting a specific description of each test administered is recommended. In general, speech perception scores can be very useful in determining a starting point on an auditory skills curriculum used in the therapeutic setting. Additionally, speech-language testing will drive goal planning for the language structures that can be integrated into auditory work as well as expectations for speech production.

Related Resources

Eisenberg, L.S., et al. (2005). *Clinical Assessment of Speech Perception for Infants and Toddlers*. Audiology Online Articles. www.audiologyonline.com/articles/pf_arc_disp.asp?article_id=1443.

Moog, J.S. (2006). *Assessing Spoken Language: Its Role in Teaching More Effectively*. HOPE Online Library. Available at www.cochlear.com/HOPE.

Tobey, E. (2003). *Spoken Language Development in Young Children with Cochlear Implants*. ASHA Continuing Education Self Study Videotape. www.asha.org/about/continuing-ed/ASHA-courses/JSS/JSS6640.htm.

Wilkes, E. (2000). *Cottage Acquisition Scales for Listening Language and Speech*. Sunshine Cottage School for Deaf Children, San Antonio, TX. Available at www.agbell.org.

Zwolan, T., & Heavner, K. (2005). *Measuring and Monitoring Progress with Cochlear Implants: Audiologists and Speech-Language Pathologists Working Together*. ASHA Leader. www.asha.org/about/publications/leader-online/archives/2005/050503/f050503b.htm.

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Habilitation Outreach for
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HOPE Note

Amount and Type of Therapy

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Determining appropriate therapy placements is a process that requires careful consideration of a number of factors. The following HOPE Note outlines some of the topics with weight in such decisions.

There is no one answer to the question, “How much therapy should a child with a cochlear implant receive?” Each child that receives an implant brings different auditory and speech skill levels to the table, regardless of age of implant or educational placement. Individualized programming is therefore key. As with any individualized plan, starting with assessment of the child’s skills and determination of his/her long-term goals will aid in answering this important question.

Immediate Post-implant Period

One observation that can be universally made is that children will need more intensive services in the early stages following implantation than they are likely to need later on. As it is in the initial months that critical auditory skill development begins, dedication to this process is crucial. An emphasis on meaningful auditory input will serve to “prime the auditory pump” and provide the basis for continued skill development. In some cases, revising academic expectations for the year may be appropriate to allow for intensive focus on auditory skill development and the growth of spoken language skills that are expected to follow. Even when auditory skills are considered to be a secondary goal to signed communication, concentrated,

early focus on the newly afforded auditory sense will assure maximum bonding to the cochlear implant and, in turn, greater benefit from the device. Of course the age of the child will dictate the practicality of length of individual sessions. Suffice it to say that new implant recipients should receive more time allocated to intervention activities than children who have used the device successfully over the years. In addition, progress in the development of auditory skills (i.e. rate of acquisition) should factor into the decision of how much and what type of therapy is necessary to continue to develop or maintain skills.

Designing Intervention

A model of integrated speech, language and auditory intervention is generally preferred over a separate but equal scheduling of speech therapy, listening practice and language development. Many school programs have made a commitment to children who receive cochlear implants by providing daily and integrated, individual speech, language and auditory therapy for the immediate post-implantation period. This is supplemented by carryover in the classroom by teachers who are knowledgeable of the intervention plan and believe themselves to be important members of the habilitation team.





Defining Professional Roles

Professionals with a variety of backgrounds might be called on to provide services for the child with hearing impairment: classroom teachers, speech language pathologists, teacher-consultants/itinerant teachers and educational audiologists. While each of these professionals has skills that will be valuable to the implanted child, it is incumbent on each to add to his/her knowledge of auditory skill development. Because auditory abilities form the base upon which language, speech and academic skills will be built, they should be incorporated into all classroom and therapy activities. A habilitative approach that addresses all of the child's learning goals will assist in determining the best "division of labor" with regard to one-on-one services.

Related Resources

Chute, P., & Nevins, M.E. (2006). *Building Collaborative Teams: Whose Job is it Anyway?* in *School Professionals Working with Children with Cochlear Implants*. San Diego: Plural Publishing.

Cochlear Americas. (2004). "Considerations at School" in *A Resource Guide for Teachers*. Englewood CO. To order, visit the HOPE Education and Rehab section of the Cochlear Online Store: www.cochlear.com/shop.

Garber, A.S., & Nevins, M.E. (2006). *Determining Therapy Needs*. HOPE Online Library. Available at www.cochlear.com/HOPE.

McClatchie, A., & Therres, M.K. (2003). "Educational Options and Support Services" in *AuSpLan: Auditory, Speech and Language: A Manual for Professionals Working with Children Who Have Cochlear Implants or Amplification*. Children's Hospital and Research Center at Oakland. Available at www.agbell.org.

Nevins, M.E., & Garber, A.S. (2005). *Push-In or Pull-Out: Models for One on One Services*. HOPE Online Library. Available at www.cochlear.com/HOPE.

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Habilitation Outreach for
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HOPE Note

Issues in Mainstreaming

*Mary Ellen Nevins, Ed.D. and Ashley Garber, M.S.
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The decision to mainstream a child with a cochlear implant is a complex one that requires careful consideration of a number of factors, each of which contributes to mainstream success. The following HOPE Note outlines important child readiness factors, receiving school readiness factors and parent readiness factors that will require consideration to make a mainstream recommendation with confidence.

Child Readiness

Historically, mainstreaming was reserved for children who, after a period of special education, had acquired sufficient skills to be successful in a general education setting. With implant technology now available to children as young as 12 months of age, the trend toward mainstreaming during the preschool years has been observed. Children who have demonstrated the potential to learn through listening are now being given the opportunity to continue to acquire skills in the mainstream rather than as a prerequisite to placement there. Regardless, consideration should be given to the child's language/concept ability when compared to his/her hearing age mates. Because the language demands of the classroom increase over time, a child must demonstrate language-learning ability that will sustain continued growth in the regular education setting. The child's speech perception and speech production

skills should be indicative of a spoken language system that allows the child to process and produce the classroom language. Finally, when the mainstream candidate demonstrates social skills that support social interaction with new hearing classmates, there is greater chance for successful placement.

School Readiness

In addition to evaluating a child's readiness for the mainstream, it is also necessary to consider the receiving school's readiness for providing services to the child with a cochlear implant. Factors such as administrative support and a school community that values and accepts all students are as important as the more practical issues of room acoustics, availability of support services and willingness of staff to learn more about the needs of a child using implant technology.

Parent Readiness

Parents should recognize that mainstream placement is yet another new beginning and not an end goal. Parents will need to accept the challenge of advocating for their child with an implant in the regular education environment.





The development of an IEP that specifies exactly the amount and types of services that will be provided to support the child is a responsibility that parents should be prepared to assume.

The exciting potential for deaf children with cochlear implants to achieve academic and social goals in the mainstream is available to many; however, it would be misleading to suggest that this accomplishment is possible for all children who receive a cochlear implant when other educational challenges are present. When mainstreaming is seen as an instructional and not a geographic decision, and when these factors are considered collectively we can be assured that children with implants will be appropriately placed in classrooms in which their fullest academic and social potential can be reached.

Related Resources

DeConde-Johnson, C. (2006). *Gearing Up My Classroom: Strategies to Support a Student with a Cochlear Implant*. HOPE Online Library. Available at www.cochlear.com/HOPE.

The Mainstream Center at Clarke School for the Deaf: www.clarkeschool.org.

Mainstream Tip series: Tips for Kids and Tips for Friends Moog Center for Deaf Education. Email: publications@moogcenter.org.

Mangiardi, A. (1993). *A Child with Hearing Impairment in Your Classroom? Don't Panic!* Washington DC: AG Bell Publications.

Nevins, M.E., & Garber, A.S. (2006). *Issues in Mainstreaming*. HOPE Online Library. Available at www.cochlear.com/HOPE.

Otto, D., & Kozak, V. (1998). *Questions Teachers Ask: A Guide for the Mainstream Classroom Teacher with a Hearing-Impaired Student*. Washington DC: AG Bell Publications.

Sorkin, D.S. (2005). *Children and Cochlear Implants: What They Need at School*. AG Bell Online Seminar. Available at www.cochlear.com/HOPE.

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HOPE Note

Issues in Reading

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Auditory access provided by the cochlear implant has enabled many children to make substantial gains in spoken language development. The critical role that well-developed spoken language plays in the development of literacy skills cannot be overstated. Thus, it follows that children with cochlear implants may bring skills to the reading task that might assist them, first, in learning to read and, later, in reading to learn. The following HOPE Note explores the relationship between auditory access and the development of reading comprehension.

Building Skills that Support Reading

It is well documented that children who have plentiful and pleasurable experiences with books at a young age have a greater chance of becoming proficient readers in later years. Reading aloud to children from the moment they have auditory access begins the process of vocabulary stockpiling that will contribute to future reading success in school. Developing the critical thinking skills required for reading with real comprehension can begin during read-alouds before any formal reading instruction is undertaken. Parents and early interventionists can assist a child in:

- **Making connections** between stories and life experiences to set the stage for independently building meaning from text.
- **Getting the main idea** through telling or retelling a story.
- **Sequencing events** by recalling the events of a story in proper order.

- **Predicting the outcome** of a new story, which allows a child to play an active role in book sharing even before decoding, is expected.
- **Making inferences** by “reading between the lines” and “filling in” from personal knowledge and what makes sense.
- **Drawing conclusions** by piecing together bits of information in a story to come up with an idea that is not expressly stated.

Breaking the Code

As the child with a cochlear implant matures, there are a number of ways in which he/she will be asked to recognize, in print, the words stored in the spoken language vocabulary. There are essentially two main approaches to beginning reading.

- **Phonics-based approaches** require that a child learns rule-governed, sound-symbol relationships. These rules are applied to text in a process called decoding. Children with severe-to-profound hearing loss who use cochlear implants are in a unique position to take advantage of phonic-based approaches because of the auditory information provided by implant technology. The ability to hear the consonant and vowel sounds of spoken language creates the first link in pairing the speech sound to a visual (letter) representation of that sound.





When these symbols are combined, recognizable words can then be identified. This is the start of reading.

- **Whole language approaches** enlist a child's own knowledge and experiential base for early reading. In whole language, children are encouraged to make connections between their background knowledge (all that is known about the world) and what they see in print to build meaning from text. The cochlear implant affords children the opportunity to access their store of experiences and spoken language representations of those experiences to assist in recall and retrieval in reading. For example, children who have been to the zoo and have had rich experiences there may then more easily read a story about animals that takes place in a zoo setting.

Reading with Comprehension

Whether a child learns to read via a phonics-based or whole-language approach, subsequent reading with real comprehension will become more challenging as the vocabulary, syntax and themes of the text become increasingly more complex. Assisting the child in developing strategies and techniques that will allow for continued vocabulary growth, adjusting purposes for reading and monitoring comprehension will be necessary components of formal reading instruction in the later elementary years and beyond.

Successful readers are often those with positive experiences with books, words and language from the earliest years. Nurturing a child's early love of reading may yield outcomes that cannot be measured for many years. This investment is well worth both the immediate results and long-term benefits of creating life-long readers and learners.

Related Resources

Fountas, S., & Pinnell, G.S. (2001). *Guiding Readers and Writers*. Portsmouth, NH: Heinemann Press.

Nevins, M.E. & Garber, A.S. (2005). *Vocabulary Development for the Cochlear Implant User*. HOPE Online Library. Available at www.cochlear.com/HOPE.

Robertson, L. (2000). *Literacy Learning for Children Who are Deaf or Hard of Hearing*. Washington D.C: AG Bell Publications.

Spencer, L., Barker, B., & Tomblin, J. (2003). Exploring the Language and Literacy Outcomes of Pediatric Cochlear Implant Users. *Ear and Hearing*, 24, 236-248.

Trelease, J. (2001). *The Read Aloud Handbook*. New York: Penguin Books.

Wilkes, E. (2005). Trends in Literacy Research and Factors Affecting Literacy Achievement in Children with Hearing Loss. *The Listener: Journal of the Learning to Listen Foundation*. pp 112 - 121.

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HOPE Note

Children Who Sign



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There are many parents who choose implantation for their children who sign. Speech and hearing professionals must ascertain the degree to which spoken language development is possible for a child with an implant who signs and maximize the potential of the devices for this purpose. The following HOPE Note outlines a rationale for encouraging auditory access while at the same time supporting sign communication.

Parent Choices

When faced with decisions about communication options for their young deaf children, a considerable number of parents choose sign language in any one of its various forms. Some will choose American Sign Language (ASL) because of a commitment to the community and culture of deafness. Others may choose a form of Signed English believing it to be the most practical approach to reaching their deaf child. Simultaneous Communication (talking and signing) is the outcome when signs are overlaid upon English grammar and paired with spoken English.

Children with Cochlear Implants

Simultaneous Communication (SC) may offer a child with an implant the best opportunity to pair audition with their established communication system. There

are several recommendations that teachers and speech language pathologists are encouraged to follow when using SC with an implant recipient:

- Use grammatically complete and correct spoken English. Even if every word is not signed, every word must be voiced in order to provide access to the rhythm and melody of English.
- Assist the child in moving across a continuum from visual learning to auditory learning.
- Provide many opportunities to listen only and to talk only. Routine events may afford the richest context for removing signs and allowing for successful listening and talking.
- Help the child see that different kinds of communication are appropriate in different settings. Make explicit the circumstances in which it is “a listening and talking time” versus “a signing time.”
- Include parents in the discussion of the relative roles of sign and spoken language to achieve the academic and social goals they have for their child. Enlist their support in setting communication guidelines for time spent outside of school.



Research on the Auditory and Speech Skills of Signing Implant Recipients

It is well documented that children who use sign make improvements with their cochlear implants although they do not perform as well on measures of speech perception and speech production as their auditory/oral peers. While progress in speech perception and speech intelligibility can be attributed to implant use, children who sign make only about half the gains that children using full time oral communication make (see Osberger reference). Rather than disappoint, this result should serve as the incentive to maximize the opportunities that a child who signs has to listen to and produce spoken language.

The Role of the Educational Interpreter

When a child who uses a sign language interpreter at school gets a cochlear implant, there is often confusion about the role of this professional in post implant habilitation. Educational interpreters should be considered part of the instructional team and should be active in facilitating the anticipated outcomes of implantation for the child. Experience suggests that after implantation and a period of listening exposure, a child demonstrates growing independence in mainstream classrooms and may shift attention from the interpreter to the teacher. Educational interpreters play a vital role in encouraging a child to use new listening (and talking) skills in the classroom and should recognize the need to allow experimentation with new auditory skills as a result of the cochlear implant.

Related Resources

Chute, P., & Nevins, M.E. (2006). *Supporting Communication with Sign in School Professionals Working with Children with Cochlear Implants*. San Diego: Plural Publications.

Clark, T., et al.(2003). *Children with Cochlear Implants Who Sign: Guidelines for Transitioning to Oral Education or a Mainstream Setting*. Boston Center for Deaf and Hard of Hearing Children. Available at www.childrenshospital.org.

Cochlear Implant Education Center. (2002). *Cochlear Implants and Sign Language: Putting it All Together. Conference Proceedings*. Laurent Clerc National Deaf Education Center, Gallaudet University, Washington D.C. Available at <http://clerccenter.gallaudet.edu/ciec/conference-proceedings.html>.

Nevins, M.E., & Garber, A.S. (2006). *Sign Language and the Cochlear Implant: The Real Story*. HOPE Online Library. Available at www.cochlear.com/HOPE.

Seal, B. (2003). *Interpreting for Students with Cochlear Implants. Registry of Interpreters for the Deaf (RID) Views*.

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