Loud & Clear!

A Cochlear Implant Rehabilitation Newsletter

Issue 2 2006

A Sign of the (Changing) Times

Five years ago, the controversial topic of sign language and cochlear implants was addressed in *Loud and Clear* (Vol. 4, Issue 2, 2001). In this issue Amy McConkey Robbins, MS, and Mary Pat Moeller, PhD, revisit the topic to discuss their perspectives on these changing times.

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Oral Communication Increases the Probability of High Outcomes in Children With Cochlear Implants

Amy McConkey Robbins, MS, CCC-Sp

Five years have passed since the original publication of "A Sign of the Times," and some changes warrant a new look at the topic. Such changes include the availability of data from new, published studies; the provision of Universal Newborn Hearing Screening that has led to earlier age-at-identification of deaf children; and the lowering of the average age at which children receive cochlear implants (CI). The last factor is a powerful variable that can profoundly impact the choice of communication mode and the expectations for children with CIs.

General Research Findings on Communication Development in Children With CIs

Several findings, listed below, summarize the recurring trends from numerous research studies that have been published in recent years (Robbins, 2006):

- **Both children using oral-only communication (OC) and those using oral plus signing communication (TC) improve in their communication**

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Use of Sign With Children Who Have Cochlear Implants: A Diverse Set of Approaches

Mary Pat Moeller, PhD

In a 2001 edition of *Loud and Clear*, Amy Robbins eloquently summarized key issues related to the use of total communication (TC) with children who have cochlear implants. She drew upon evidence from empirical studies to challenge an educational attitude of "business as usual" and to encourage pedagogical modifications that maximized auditory development. She pointed out that few educational programs, at the time, had modified their educational philosophies in spite of increasing evidence of the need for auditory instruction opportunities for children with cochlear implants. She introduced the concept of viewing the student's skills on a learning continuum from fully visual to fully auditory and the implementation of strategies to facilitate the child's movement along the continuum. Five years later, have the challenges she set forth made a difference? Has the face of total communication continued to change and evolve with the advent of new technologies and earlier ages of implantation?

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skills after implantation, but OC children outperform TC children on most measures of auditory speech perception, speech production and language. This trend is robust, occurring in multiple studies from different centers in different countries and using different assessment tools. This finding was reported in the 2001 *Loud and Clear* based on published studies available at that time; studies published since continue to support this finding (Geers, Nicholas, & Sedey, 2003; Tobey, Geers, Brenner, Altuna, & Gabbert, 2003; Kirk, Miyamoto, Lento, Ying, O'Neill, & Fears, 2002; Hammes, Novak, Rotz, Willis, Edmondson, & Thomas, 2002; Geers, Brenner, & Davidson, 2003; Nikolopoulos, Dyar, Archbold, & O'Donoghue, 2004).

- **CIs allow many (not all) children with profound hearing loss to begin to learn language at a rate that is equivalent to that of normal-hearing (NH) children, i.e., one year of language growth in one year's time** (Svirsky, Robbins, Kirk, Pisoni, & Miyamoto, 2000; Robbins, 2003). This effect seems to be particularly true for those implanted in the early years of life. Recall that while the average child with a CI demonstrates a normal learning rate, some children with a CI demonstrate more than one year of growth in a year's time, whereas others demonstrate a considerably slower rate of language growth.
- **Many children remain delayed in their language skills even after implantation.** This is the case largely because of the delays that already exist in children's language at the time they receive their implants.
- **A wide range of language benefit is observed across implanted children, regardless of communication mode used.** It is important to keep this large performance variance in mind, especially when reviewing data that have been averaged across subjects. In addition, up to 40 percent of children with hearing loss have additional developmental or learning disabilities (Parrish & Roush, 2004; Yoshinaga-Itano, Sedey, Coulter, & Mehl, 1998). Among that group, a rate of development equivalent to that of NH children would be the exception, rather than the rule.
- **Morphosyntactic development, particularly in expressive language, lags behind other language skills in children with CIs.** Even in children with CIs whose comprehension of language is age appropriate, expressive use of morphological markers is often delayed (Geers, Nicholas, & Sedey, 2003; Kirk et al., 2002; Nikolopoulos et al., 2004; Tomblin, Spencer, Flock, Tyler, & Gantz, 1999). This same persistent difficulty with morphosyntactic skills is also documented in NH children with specific language impairment (Goffman & Leonard, 2000; Rice, Wexler, & Hershberger, 2002).

Research Evidence Comparing Performance of OC and TC Children With CIs

One confounding factor in examining research findings is that the broad term *signing* is used to describe a wide range of programs that are known to vary in the way sign is implemented, the sign system or language that is used (e.g., SEE versus ASL), teacher expertise in auditory skill development and the overall quality of classroom instructional practices. While these factors cannot be discounted, it must also be recognized that great variability in quality and intensity is also present in programs labeled *oral*. In both signing and oral educational programs, the range of practices and competence is enormous, and most studies have not controlled for such variability.

Even so, there is persistent evidence that, as a group, children with CIs from the broad range of oral programs listen better, speak better and have more highly developed underlying language skills than do children from the broad range of signing programs. In other words, in children with CIs, use of oral communication is positively correlated with proficiency in speaking, listening and communicating. What remains debatable is the degree to which this correlation is a cause-and-effect relationship (Dowell, Dettman, Blamey, Barker, & Clark, 2002).

> In other words, in children with CIs, use of oral communication is positively correlated with proficiency in speaking, listening and communicating.

One study did attempt to account for an important variable in educational programs: the degree to which auditory and speech skills were emphasized in classrooms where OC or TC was used with children with CIs. Geers and Brenner (2003) used a rating scale that reflected how much auditory emphasis existed in the oral classrooms and how much speech emphasis existed in the TC classrooms of children with CIs. Higher levels of speech and language were associated with children whose oral programs were rated as *strongly auditory*. Among TC children, better performance was associated with programs rated as *speech emphasis* (Geers, Spehar, & Sedey, 2002).

Evidence from Selected Studies

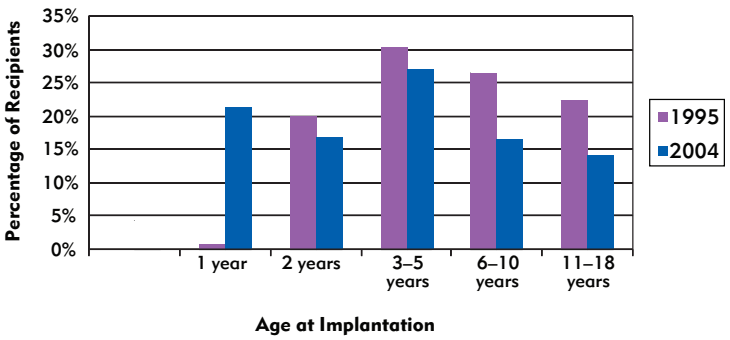
Underlying language skills have been the domain where TC children with CIs have competed most favorably with OC children. Typically, underlying language skills are assessed in the child's preferred mode of communication (i.e., TC children are tested in speech plus sign; OC children are tested in oral-only mode). Under these conditions, OC and TC children sometimes have demonstrated equivalent language benefit from the CI when certain aspects of language are tested (Geers, Nicholas, & Sedey, 2003; Connor, Hieber, Arts, & Zwolen, 2000; Robbins, Svirsky, & Miyamoto, 2000).

Geers et al. (2003) found no significant differences in language comprehension or verbal reasoning between the scores of CI children who were in OC educational programs and those in TC programs. However, enhanced benefit to OC children becomes apparent when other aspects of language are assessed. Geers found that many implanted children who used OC outperformed their TC counterparts on spontaneous language samples when breadth of vocabulary and morphosyntactic aspects of language were assessed, including use of bound morphemes, utterance length and narrative form. *These advantages were apparent regardless of whether the children used signed and/or spoken language.* A similar advantage of TC over OC performance was reported by Kirk et al. (2002).

Interaction Between Communication Mode and Age at Implantation

One factor to consider is the powerful, positive influence that early age at implantation has on performance. The average age at implantation has lowered dramatically over the last decade as a result of Universal Newborn Hearing Screening, increased knowledge about sensitive periods of auditory learning, and evidence that early auditory deprivation can induce degenerative changes within the auditory pathway (Moore & Niparko, 2000) and impair the development of neural pathways connecting the auditory cortex to other cortices (Kral, Hartmann, Tillein, Held, & Klinke, 2000; Ponton & Eggermont, 2001). Later age at implantation delays the onset of auditory input and, therefore, of neural pathway development. In addition, data suggest that, even in children implanted younger than age 3, earlier implantation provides an advantage (Hammes et al., 2002; Robbins, Koch, Osberger, Phillips, & Kishon-Rabin, 2004; Sharma et al., 2004).

FIGURE 1



The lowering of age at implantation over the last several years may be seen in Figure 1, which shows the percentage of children implanted at different ages with a CI (manufactured by Advanced Bionics) in 1995 and in 2004. In 1995, the percentage of children receiving their implants between 1 and 2 years of age was 0.8 percent. In 2004, 21.4 percent, or almost one quarter, received their device between ages 1 and 2. Note also the changing distributions in the other age groups.

FIGURE 2

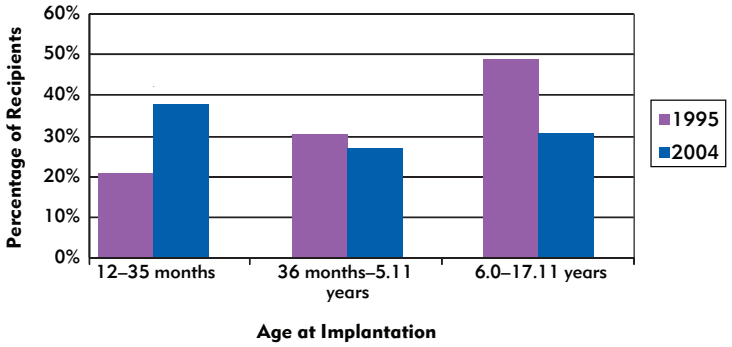


Figure 2 shows the same data as Figure 1, but with ages combined into three larger groups. Note that only 20 percent of all implants in 1995 occurred in children before 3 years of age. Nine years later that number had increased to 38 percent of pediatric CI recipients (and may have increased since 2004). This means that we have unprecedented opportunities to intervene with these very early implanted children who now make up a substantial portion of all pediatric recipients. Via the implant, they are provided with auditory access to the spoken language code at a time in their development when dramatic improvements in communication are still possible and when their ability to generalize and learn from the environment is at its peak.

As seen in the far right column in Figure 2, almost 50 percent of pediatric CI recipients in 1995 were between 6 and 18 years of age, whereas in 2004 that number had dropped to approximately 30 percent. Clearly, the proportion is shifting toward earlier implantation, with the most dramatic increase in implantation of children between 12 and 23 months (see Figure 1). Thus, we see an increase in implantation of much younger children and a decrease in implantation of older children. With the population of children receiving CIs changing in this direction, have educational practices and expectations changed accordingly?

Older notions, valid at the time, about how much visual support a child needed after cochlear implantation may be becoming obsolete for many children and do not represent a state-of-the art approach. Why? Because neural plasticity, incidental learning potential and auditory capacity are so much higher in the very early implanted child, while the delay in that child's language is considerably smaller and may close more quickly within an environment of rich, meaningful auditory experiences. Clinicians should weigh these factors when considering the use of sign language as a temporary measure (i.e., signing to a child between the time of diagnosis and implantation). As with any clinical tool, there are potential advantages and disadvantages to using sign language with very young children and to teaching families to do so (Table 1, page 5). In addition, age at implantation becomes a variable that influences and can profoundly impact communication modes. Several studies have

examined this interaction. Kirk et al. (2002) reported that in 73 implanted children: a) children who received implants before 3 years of age had significantly faster rates of language development than did those implanted after age 3; and b) among the early implanted children, OC children were acquiring age-appropriate expressive language skills whereas TC children were not.

Hammes et al. (2002) compared language development in 47 children implanted by 48 months of age. These authors found that children implanted under 18 months of age had substantially better language outcomes than those implanted after 18 months of age. The majority of the subjects used TC prior to implantation, yet a strong shift to spoken language was observed after implantation for the youngest children. All of the children implanted under 18 months of age made successful transitions to spoken language. As age at implantation increased, fewer children became competent users of spoken language. In fact, of 22 children who received their CIs between 31 and 48 months, more than half remained dependent on sign language, even after nine years of implant use. In one study, Blamey et al. (2001) found that the average rate of language improvement was slower than the rate reported by a number of other investigators. Some children in the Blamey study had received their CIs at ages as late as 8 years, a factor that likely accounts for the slower rate of language growth.

Clinical Implications

There also appears to be an additive effect of early implantation and superior speech processing strategies. When two powerful influences come together—that is, state-of-the-art technology and early age at implantation—the communication benefit derived by deaf children is unparalleled. Another potent force that must be factored in is the ability of younger children to learn language incidentally. With that said, it should be emphasized that early implantation alone does not guarantee highly competent oral and auditory children.

When I consulted to a program with a large group of children who were implanted early (many with bilateral implants) but whose educational setting and parent input was highly manual, I found that 18 months after implantation, the children did not alert to environmental sounds, did not detect their names and had only rudimentary vocalizations. Their communication environment failed to make listening and spoken language meaningful, yet the well-meaning parents wondered when the implant was going to make their child "start to talk." What this program failed to do was to use a proactive habilitative approach where adults purposefully teach children what to listen for. Tyszkiewicz and Stokes (2006) note that, without this approach, the CI merely increases the quantity and volume of sound the child hears, resulting in auditory learning that is likely to be random and unfocused.

Continuing Challenges for TC Programs Serving Children With CIs

It is important to acknowledge the data showing that some TC children with CIs are doing very well in learning to listen and talk. Geers, Spehar and Sedey (2002) reported on some TC children with CIs whose speech was up to 98 percent intelligible (range = 0 to 98 percent) and whose speech perception scores were as high as 76 percent (range = 0 to 76 percent). Some TC programs have also adopted dynamic models of sign use, wherein the amount of sign versus spoken language depends on the child's skill level and tends to decrease over time (see Moeller, this issue). These changes come amid real challenges facing TC teachers. In my visits to many school placements for children with CIs, both OC and TC, some observations include:

1. **TC teachers have great demands on their time to stay current in many areas of pedagogy.** In fact, because of the bimodal nature of their instruction, they theoretically have twice the information about which to stay informed. It is my impression that many TC teachers have less time to read the literature about what state-of-the-art CIs are capable of providing. Many teaching models based on what were reasonable expectations five or 10 years ago are obsolete. That means that if teachers don't stay current, read literature and, especially, have opportunities to observe successful, early implanted children, they may be operating with both outdated information and expectations that are too low.

2. **Audition, in some TC programs, continues to be viewed as a set of discrete skills to be trained during therapy rather than as a part of the child's personality and daily interactions.** Wearing the CI is considered non-negotiable in OC programs, given the need for constant, rich auditory input and the fact that the CI is the child's only link to classroom communication. Some TC programs have moved in this direction as well, with strong emphasis on the need for CI children to listen all day, every day. On the other hand, I recently observed an elaborate playground, newly erected at a school for the deaf and advertised as "fully accessible" to all students because it has ramps, a wheelchair slide and other wonderful accommodations. All the new slides, however, are plastic, even though published information over the last 10 years discourages this. (Due to electro-static discharge issues, plastic play equipment has been considered inappropriate and inadvisable for CI users.) This means that the CI children in this program are not able to wear their implants on the playground during this important time of socialization and natural communication with others. This simply would be deemed unacceptable in most OC programs where every activity is considered a listening opportunity, especially when socializing with peers.

3. Aggressive audiological management may be more common in OC than in TC programs. Data show that a well-fitted CI program, as evidenced by wide dynamic range and optimal growth of loudness characteristics, is associated with high levels of performance in CI children (Geers, Brenner, & Davidson, 2003). Some TC teachers take an aggressive approach to the CI equipment and encourage families to seek the latest upgrades in technology. However, my clinical impression is that OC teachers are more likely to do so because OC teachers observe every day the child's dependence on hearing. For TC teachers, their students also have the visual modality through which to receive language, and this can mask difficulties the child is having with his CI. Thus, it may take longer in TC programs for teachers to become concerned about listening behaviors and to refer the child for CI reprogramming.

Pre-CI Counseling Information

Clinicians recognize that, pre-implant, we can never perfectly predict how an individual child will perform with the device. We can, however, state the probability or likelihood of high performance based upon certain characteristics. For clinical counseling, it is our responsibility to discuss with parents those factors known to be associated with higher performance post-implant.

For children implanted before age 5, the probability of achieving high levels of intelligible speech and speech understanding is greater if the child is educated in an OC classroom. Children who are in classrooms that emphasize dependence on listening and talking have higher speech production and speech perception scores than children in programs that put less emphasis on these behaviors.

It is possible that, for some parents, other priorities will take on greater value as these parents make decisions about their child's mode of communication post-implant, and informed parent choice should always be respected. Nevertheless, it is the clinician's responsibility to ensure that as families make communication choices, they are fully informed about research results and the greater likelihood of high levels of performance associated with oral classroom placement.

In the *Loud and Clear* issue five years ago, we posed two questions. The answers to these questions, according to published data currently available, remain the same now as they were then: Do children who use TC benefit from a cochlear implant? The answer continues to be a resounding yes. Do TC children benefit to the same extent as do OC children? The answer remains a disappointing no.

Continued on top of page 6

Table 1

Advantages and Disadvantages of Signing to a Deaf Baby Prior to Cochlear Implantation

POTENTIONAL ADVANTAGES

- Parents can communicate with child via unimpaired modality (vision)
- Can express in sign + speech what child doesn't understand in speech alone
- Parents feel they are doing something active, not just waiting passively for a CI
- Lays a foundation for symbolic communication; keeps brain active
- If started early, parents' skills can grow with child's skills
- Helpful when child is not wearing device—bath, swimming, device malfunction
- Disambiguates child's unintelligible speech attempts
- Child is less frustrated, discipline is easier, behavior improves
- Cognitive energy of parents and child is focused on sign
- Theoretically, transition to spoken language smooth and rapid

POTENTIAL DISADVANTAGES

- Signs do not utilize or stimulate residual hearing, which most children have with hearing aids
- Simultaneous sign and speech don't coordinate well—speech loses its natural intonation/prosody
- Requires a commitment to do it—sign is not a known skill for most families of deaf children
- Interferes with spontaneous flow of communication; must think: How do I sign that?
- Demand on parents' time/energy to learn and practice; one parent is often more proficient than the other
- Investment of time required to learn sign may not be worth the infrequent use
- Reduces child's opportunities to develop oral communication repair strategies
- Sign alone doesn't improve behavior; parents still must have commitment to consistency and consequences
- We have finite amount of cognitive energy; something else will get less energy/focus
- Experience suggests transition to spoken language is not always smooth or rapid

Robbins, continued from page 5

For a deaf baby who is going to get a cochlear implant, I would be *more likely* to recommend stopgap use of signs under the following conditions:

1. There is a family desire to sign.
2. There is no usable residual hearing with hearing aids.
3. The child will get a CI when older than 18 months of age.
4. The child's frustration is high.
5. The parents' frustration is high because of lack of communication.

For a deaf baby who is going to get a cochlear implant, I would be *less likely* to recommend stopgap use of signs under the following conditions:

1. The child has some usable hearing with hearing aids pre-implant.
2. The child is enrolled in a strong parent-infant program with an auditory emphasis.
3. The parents are able to utilize good oral techniques at home.
4. The child will receive a CI at 18 months of age or younger.
5. The frustration level at home is tolerable.

As with all communication decisions, the use of signs must be made on an individual basis, considering the unique needs of the child and the family. L&C

Use of Sign With Children Who Have Cochlear Implants: A Diverse Set of Approaches

Moeller, Continued from page 1

This brief concept paper revisits the issue of using signs with children who have cochlear implants, with the goal of raising some new challenges and considerations. The field has witnessed remarkable changes in many deaf children's spoken language learning rates in response to early implantation with current generation technologies (Kishon-Rabin, Taitelbaum-Swead, Ezrati-Vinacour, & Hildesheimer, 2005; Nicholas & Geers, 2006; Schauwers, Gillis, Deamers, De Beukelaer, & Govaerts, 2004; Svirsky, Robbins, Kirk, Pisoni, & Miyamoto, 2000). As we reflect on the promise of new technologies for children and families, it is relevant to consider some conventional wisdom that must continue to guide the education of deaf children.

In this era of new technology, it remains the case that children with severe to profound hearing loss represent a highly heterogeneous population with individual constellations of abilities and learning needs. The combined benefits of early identification and early cochlear implantation continue to reduce the number of children who require TC or signing approaches for communication development. However, given the diversity in the characteristics of children and their circumstances, it is unlikely that any single approach will be able to meet the broad spectrum of children's learning needs. Empirical studies consistently demonstrate wide ranges in the performance outcomes of children who have cochlear implants (Geers, Nicholas, & Sedey, 2003; Kirk et al., 2002). Although some of the variability has been explained by child characteristics, implant processing schemes and educational/communication methods, it is likely that a complex interaction of program qualities, device features and individual factors contribute to the repeatedly observed phenomenon of wide individual differences. This supports the need to continue to provide individualized approaches to management that fit the specific needs of children and families. For children who do sign, we must recognize that their learning preferences may shift over time in response to the provision of a cochlear implant. This requires professionals to be vigilant observers and strategic implementers of differentiated instruction to meet the changing needs of children.

Few would argue with the *need* to determine what approaches and strategies represent a "best fit" for individual children and families. But *how* and *when* to objectively make such determinations remains a topic of debate. This process would be enhanced by: a) more empirical data on children with current CI technologies; b) longitudinal studies to provide guidelines for expected rates of development (see Robbins, A., 2005: Clinical Red Flags); c) collaboration among educators representing various communication approaches to identify ways to adapt programs for individual children; d) broadened definitions of outcome and creation of better measurement tools for young children; and e) more consistent use of parent-professional partnerships in the decision making process.

Interpreting Outcomes

Recent evidence shows that, on average, children with cochlear implants educated in programs emphasizing oral communication outperform children in TC programs on a variety of outcome measures (Tobey, Rekart, Buckley, & Geers, 2004; Geers, Nicholas, & Sedey, 2003). How should TC programs interpret these findings? Should they be seen as a wake-up call for TC programs? Some professionals point to these findings as evidence that signs interfere with spoken language development. They may take the view that total communication is usually, if not always, counterproductive for children with cochlear implants. Some take a more conservative view, noting that there may be inherent differences between children enrolled in oral and TC groups,

making group comparisons from research impossible to interpret. Others claim that there is no evidence that sign interferes with spoken language development. Perhaps what we need to avoid is all-or-none thinking. Perhaps the evaluation tools we use should depend on the learner and where that child is positioned at a particular time on an auditory to visual continuum of perceptual skills (Robbins, 2001; McClatchie & Therres, 2003).

In our efforts to implement evidence-based practice, we need to interpret the literature with attention not only to average data from well-controlled studies, but also to the ranges in performance. Some children from *both* oral and TC groups perform significantly below average in their auditory and spoken language skills. These children require our professional attention and collaborative expertise. As a field, we need to better understand the characteristics that appear to contribute to below average performance in these children so that alternate strategies may be employed. However, we also need to consider that the quality and intensity of spoken language instruction as well as levels of expectation may play key roles in bringing about positive outcomes. Striving for excellence in these areas will benefit children, regardless of approach taken. We must also recognize that the overall picture of outcomes is changing as more children receive newer-generation devices as infants and toddlers.

In the case of children with limited outcomes from the CI over time, some may benefit from the addition of visual communication methods; others may benefit from more concentrated attention on auditory methods. A balanced approach incorporates diagnostic teaching and ongoing monitoring of outcomes to determine efficacious methods for individual children.

Another factor that could lead to differing conclusions from outcome data is an assumption that all signing or TC programs are created equal. In actuality, what is called a signing, bilingual or TC approach in one program may vary markedly from another in the amount of time and the level of expertise devoted to the development of auditory and/or spoken language skills. This suggests the need for direct measurement of the intervention program in studies where intervention effects are a primary research question. It also suggests the need for programs to engage in action research and self evaluation to answer several key questions in relation to children in their programs who have cochlear implants:

- Are we devoting sufficient time and expertise to auditory development within the curriculum? Importantly, the definition of what is "sufficient" may vary depending on the individual child. Auditory development is not synonymous with auditory exposure (Chute & Nevins, 2006). Simultaneous use of sign and speech or even periods of speech-only instruction provide *exposure*. Considerable time needs to be devoted to systematic auditory development within the curriculum.
- Are our teaching strategies altering over time in response to the changing performance and learning preferences of children with cochlear implants?
- Are our expectations as well as parental expectations for auditory and spoken language performance high enough?
- What criteria will we use to determine whether a child should continue in a TC approach? Is this child making a transition to an auditory-oral approach, and if so, how should the program be altered?
- How might we partner with auditory-oral educators or consultants to enhance the auditory aspects of our program?

We might achieve a balanced approach by considering that signing approaches (TC, bilingual) are not applied in a uniform way with all children who use cochlear implants. As practices evolve in this new educational era, we have observed at least four different ways in which signs are used in educational programs with children who have cochlear implants: Foundational use, Transitional use, Differentiated (Strategic) use and Dominant use. These approaches differ in the extent to which visual communication is emphasized and/or where in the developmental period the approach is utilized. In the next sections, these categories will be described and illustrated in relation to case studies.

Foundational use. Some families elect to use sign in the first year of life, following early identification but prior to cochlear implantation. Koch (2002) describes this as the use of sign as a supplement to early spoken language development. She notes that the intact sensory system can be used to stimulate symbolic language learning and early communication. Once the child receives a cochlear implant, auditory meanings may be mapped onto existing symbolic concepts. Some researchers have suggested that sign as a precursor to cochlear implants may enhance post-implant development (Yoshinaga-Itano, 2006), while others suggest that it may make little difference what happens pre-implant as long as implantation is early (Archbold et al., 2000). Koch (2002) suggests that the foundational inclusion of sign communication in the home should be accompanied by transitional activities to promote spoken language following implantation. This might include: a) Selective use of signs to promote language comprehension, reciprocity and symbolic development; b) aggressive auditory-vocal stimulation; and c) use of spoken language interactions with sign support to clarify meanings.

We closely observed three hearing families who elected this approach with their young deaf children over a longitudinal period. During the first year, the families used signs to supplement spoken language to foster language understanding and communication with their infants. In all three cases, the children received cochlear implants early (12 to 16 months), and all three children made a rapid transition to reliance on

spoken communication. As the children shifted toward understanding spoken phrases and production of spoken forms, family reliance on sign use decreased. Families were observed to use sign on occasion to clear up an auditory confusion (sticker/sucker), but the majority of interactions were negotiated through auditory and oral communication. In response to these shifting communication patterns in the family, all three children were transitioned to oral education settings. These examples are not meant to constitute evidence. Rather, they are meant to illustrate the flexibility with which communication modes can be used within a family as developmental abilities and goals change. In the case of these foundational users, the families were adaptive in their communication in response to the changing abilities of the child. Even though their children became oral communicators, all three families developed positive attitudes about using sign language as a communication resource.

In an effort to objectively consider all options, our team considered the potential disadvantages of this foundational use of signs. In some communities, a shift from use of sign to a spoken language approach may require a transition from one educational program to another. This can be challenging for families in early intervention. Some programs may foster reliance on visual skills to the exclusion of practice on auditory skills. This may not maximize pre-implant oral readiness skills. Further research is needed to determine what mix of emphasis on visual vs. auditory skills pre-implant is optimal. It may be the case that this mix is dependent on the individual needs and abilities of the child, making it hard to generalize. This suggests the need for ongoing monitoring of outcomes in visual and auditory modes within this approach.

Transitional use. The transitional use of signs applies to children who are already participating in total communication or bilingual programs at the time a decision is made to obtain cochlear implants. This may be particularly applicable to children who are older than 3 years of age at the time of implantation. Following cochlear implantation, signs continue to be used for a period of time to establish a bridge between the new auditory signals and the children's existing language knowledge. Teachers work to shift emphasis toward listening and auditory development at home and at school. Over time, there is increasing emphasis on interactions that encourage reliance on auditory and spoken language skills. Staff members examine program characteristics for the individual child to determine if auditory and spoken language opportunities are increasing. Four questions guide this analysis:

1. Are the classroom and home environments encouraging reliance on spoken language and auditory development while providing consistent language access?
2. Is the child getting enough opportunity to develop auditory skills and use spoken language?
3. Are expectations for auditory learning and spoken language performance high enough?
4. Are expectations changing as the child matures and gains new skills?

Two children in our program fit the category of transitional users. Child 1 (C1) received his cochlear implant at 19 months of age. He had meningitis in infancy, but his parents chose to place him in a signing program before a cochlear implant was available to him. Following cochlear implantation, this youngster developed age appropriate speech and language skills with 100 percent speech intelligibility scores by 6 years of age. He remained in a TC program throughout his preschool years. He then entered a mainstream education program, with use of an interpreter for large group instructional settings. Interestingly, Robbins (2001) pointed out the influence of anecdotal experiences on teacher beliefs. In this case, the rapid progress of this student was pointed to as evidence that children with cochlear implants are able to thrive in a TC environment. However, a second case of a transitional user of sign taught the staff a different lesson, including the importance of avoiding all-or-none thinking.

Child 2 (C2) was identified at 11 months of age with profound deafness and a Mondini malformation. He received an implant at 21 months of age. He had been enrolled in a TC program prior to the implant, and his parents desired to continue that approach. This student made excellent progress in visual language, producing complex language (e.g., object complements) by age 4. However, his speech remained largely unintelligible, and he was reluctant to speechread unfamiliar persons. Although his language skills were excellent, his ability to converse in spoken language was quite limited. At age 4, his attempts to produce individual spoken words increased. The staff examined the questions defined above and hypothesized that his current educational context and peer group did not provide sufficient opportunities for reliance on spoken language. The family and staff decided to enroll this student in a signing program in the mornings and in an oral program in the afternoons. After 9 months in this combined approach, C2 was able to rely on spoken language for face to face interaction. His open set word recognition was measured at 24 percent (PBKs), which reflected a major, albeit limited, functional improvement in auditory skills. As a result of inclusion in an oral program, this child made marked strides in speechreading, speech perception and production, incidental learning and confidence in interaction with peers and adults. He produced speech that was intelligible to unfamiliar listeners.

These two transitional students required vastly different educational strategies. For one, business as usual in the TC program was effective. For the second child, collaboration with the oral school was essential to bring about success. The staff learned the value of critically examining outcomes and being willing to try previously untapped resources (e.g., dual

placement) to facilitate progress. This required the staff to be open to the possibility that the current environment did not have all of the necessary features to promote C2's auditory and spoken language at the expected rate. This experience also led the staff to examine ways the TC program could increase opportunities for spoken language participation. Strategies adopted included: a) providing the staff opportunities for teacher observation and mentoring by experienced teachers of children with cochlear implants (e.g., Mary Koch, Amy Robbins); b) including in the daily routine several small group sessions where reliance on spoken language is fostered (Chute & Nevins, 2006); c) monitoring teacher default strategies (e.g., tendency to sign at the first struggle instead of asking the child to think about what he heard); d) observing other programs to influence teacher expectations; e) examining how lessons cultivate global, discrete and generalizable skills in listening; and f) providing coaching to family members on increasing expectations for listening and speaking clearly during daily routines.

Differentiated (Strategic) use. While teachers may find the need for differentiated (or strategic) instruction for students who benefited from transitional strategies (described above), they may also need occasional visual supports in certain lessons or communication circumstances. In our experience, teachers have implemented this approach for children who: a) have significant difficulty comprehending in noisy situations; b) prefer visual support for learning cognitively complex ideas, but once learned, can transition to spoken use; c) have oral motor challenges that interfere with speech intelligibility (sign can be used to clarify the intended message); d) have signing deaf peers with whom they want to communicate; or e) have learning styles that are boosted by visual support (e.g., memory, word storage and retrieval are enhanced by instruction that includes differentiated use of sign).

This group may include children who are later to receive cochlear implants and have previously established communication through sign. In such cases, it is an advantage to use the child's foundation in knowledge of sign to support auditory learning. Sign can be used to facilitate learning and ease communication frustration. A challenge of such an approach is to objectively determine the appropriate mix of emphasis on visual and auditory skills. This requires adaptive analysis of context, lesson complexity and student responses. It requires fluency in sign and a high level of competence in methods for developing spoken language skills.

Teachers found it effective to use differentiated use of sign with Child 3 (C3), who had auditory neuropathy. Before CIs were being used with children who had auditory neuropathy, C3 was an unsuccessful user of conventional hearing aids. He developed strong language abilities through a signing approach, and although his speech skills improved, his intelligibility was reduced. After receiving a CI at 7 years, 8 months, he made major strides in his auditory skills, and his understanding of spoken language was within the average range by 9 years of age. However, oral motor difficulties impeded his speech intelligibility. In his case, teachers instructed him to use signs strategically to clarify selected words that were hard for him to produce. He also used sign for social interaction with deaf classmates at his mainstreamed school. His receptive learning was fully supported by auditory-oral communication in the classroom.

Dominant use. Dominant use refers to an educational program in which there is primary emphasis on visual communication (e.g., sign); spoken language may be addressed in selected contexts, but the degree to which it is addressed may depend on the child. At least three distinct applications of a sign dominant approach can be seen in practice: a) families who elect a bilingual/bicultural approach; b) families with more than one deaf child who signs; or c) children who obtain limited benefit from the CI. For children in each of these circumstances, teams must consider issues broader than auditory access. Children's circumstances may mandate visual access to language development, as well as social and cultural access to communication. When families elect a bilingual/bicultural approach and a CI, they should be supported to gain a full understanding of the unique communication commitment required by such an approach. They can be encouraged to develop partners who can help them achieve the necessary skills. For children who, for whatever reason, receive limited benefit from the device, it is of value for professionals and families to view sign as a valuable educational resource.

Child 4 (C4) required dominant use of sign in his educational program. He used sign in infancy and subsequently immigrated to the U.S. He received a CI at 4.5 years of age and demonstrated several "red flags" (Robbins, 2005) reflected in slow auditory development and language comprehension struggles. Although most readers are familiar with the use of the "Auditory Sandwich" technique (Koch, 1998) of "say it, sign it, say it," this student profited from a "Dagwood Sandwich." This meant that when new ideas were introduced, communication proceeded as follows: 1) visual (task directions were signed so that he understood the expectations; otherwise, he responded in an echolalic manner); 2) auditory; 3) auditory-visual (speechreading helped confirm that he got the auditory message); 4) auditory again; and 5) visual (to check his comprehension of the auditory signal through the most expedient channel). Over time, he progressed from being a mostly visual communicator to a balanced auditory and visual communicator. Remaining in a program with dominant use of sign greatly supported his educational goals, while allowing him to progress in developing spoken language skills.

Educational programs using sign may have students represented in each of the above categories. This requires a staff with a broad range of

skills and a commitment to ongoing evaluation of student processing skills, learning preferences and changing needs. In short, this is a tall order. Educational teams benefit from a systematic program of leadership and consultation that supports them in incorporating new skills and curricular methods so that optimal outcomes for children are achieved (Koch & Carotta, 2006).

When reading articles that compare spoken language to TC, we need to consider the reality that programs using sign are diverse in their goals and strategies. As our educational methods mature in response to new technologies and early identified children, we would do well to: a) avoid all-or-none thinking and instead improve our abilities to understand individual learning profiles; b) strive toward excellence in teaching and high expectations for outcomes with children; c) critically examine our practices and seek consultative support; d) partner with family members who desire for children to sign and speak, help them examine their own expectations and practices, and understand the key role of auditory development in outcomes; and e) consider creative collaborations between oral and signing programs to provide the best for children whose performance is below expectations. L&C

Educational Approach	Description	Advantages	Considerations
Foundational	• Early identified infant; early CI planned • Family elects to use sign during pre-implant period • Goal to stimulate symbolic development and communication via intact visual channel • Plan to use sign as a short-term clarifier as listening develops • Sign is viewed as a short-term supplement or bridge to language and communication development	• Potential to develop symbolic communication skills on schedule through intact sensory system (Koch, 2000) • Signs can clarify meaning of spoken symbols and sounds to support oral learning • May contribute to flexible attitudes about communication over the long term	• Program must ensure that pre-implant oral skills are also developed • Family may need to make a transition in primary education provider (collaborations can ease this process) • More research is needed to understand best ways to use multi-modal language stimulation in infancy
Transitional	• Child has been in a total communication program prior to CI • Language/communication in sign is well established • Family goals are focused on developing fluency in spoken communication • Program is adapted to intensify auditory-oral training and opportunities for listening and speaking • Child transitions to reliance on spoken communication • Timeline for transition may vary; some students may continue to use sign in certain contexts (see Differentiated below)	• New auditory skills can map onto existing language foundation • Existing language in sign can supplement auditory learning when there is confusion	• Must ensure that program provides enough opportunity for auditory development • More research is needed to define what is enough for individual children • Parents may benefit from coaching to increase expectations for perceptual learning and spoken language use • Family and clinician need sign fluency for complex communication and an understanding of how to develop listening skills
Differentiated (Strategic)	• Student has specific needs that are met by reliance on sign + speech for reception and expression • May include children who receive CI at later ages who benefit from visual support in noise, for complex learning and for socialization • Students with additional disabilities such as oral motor difficulties that reduce speech intelligibility; sign used to clarify intended meaning as needed	• Takes selective advantage of the student's foundation in sign skills to support learning or language use • May be an aid to learning, retention and retrieval for students with multiple disabilities • May ease communication frustration when there are breakdowns • Existing language in sign can supplement auditory learning when there is confusion • Child and family have additional communication tools for interaction with individuals who sign	• Need for greater sophistication in assessment and diagnostic teaching to determine which children may benefit • Requires adaptive teaching to provide the right mix of visual and auditory instruction for individual children • Requires fluency in spoken and sign approaches
Dominant	• Children enrolled in bilingual/bicultural approach; goal is to separately develop ASL and spoken English • May include students with older signing siblings or other signing family members • Category also may include students who develop listening skills slowly with cochlear implants (in spite of best practices)	• Broadens communication, cultural and social access for children in families with multiple signers and in families who elect a bilingual approach • Sign can enhance learning in children who receive limited benefit from the CI	• Hearing families need to understand unique commitment(s) required to promote bilingualism in visual and spoken modes • Family and clinician(s)/teacher(s) need sign fluency for complex communication and an understanding of how to develop listening skills • For child who receives limited CI benefit, sign should be viewed as a key educational tool, not as a limitation

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