



Review Article

# 12 guiding premises of pediatric cochlear implant habilitation

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It has been almost 35 years since the editor of this issue, Dr. Richard Miyamoto, introduced me to the child who would be my first pediatric cochlear implant (CI) patient. Dr. Miyamoto had hired me as part of his co-investigator team at Indiana University School of Medicine. He had implanted many adults over the previous 5 years, but entering into the world of pediatric cochlear implantation was truly a remarkable frontier. That first child, implanted with a single-channel House 3M device, taught me a great deal about how electrically-evoked hearing could contribute to the development of speech, language and literacy in a deaf child. Since that time, Dr. Miyamoto and I have a combined experience working with over two thousand children with CIs, and each one has taught us something unique. We have

witnessed remarkable advances in implant technology, the provision of universal newborn hearing screening in the United States, and the very early fitting of hearing technology (traditional amplification and cochlear implants) on babies. It is difficult not to stand in awe of how well most children with implants are learning to listen and talk, to integrate in their neighborhood schools, play musical instruments, and even become bilingual in two or more spoken languages. These benefits, however, occur in those children who receive both excellent surgical placement of their devices and well-designed follow-up habilitation. Surgical insertion of the device is not enough, as Dr. Miyamoto often reminded us. When team members work together to provide a program that includes intensive listening and spoken language habilitation, the rewards are great.

In this article, I will review twelve guiding premises that form the foundation of habilitation for prelingually deaf children with CIs.<sup>1</sup> These premises are an amalgam of research findings and clinical experience with a broad range of implanted children. Note that much of what enhances learning in children wearing CIs is consistent with communication developmental in all children. We believe that a

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developmental approach needs to be taken to its fullest manifestation over a protracted period of time in children with CIs in order for them to enjoy high levels of auditory, spoken language and literacy success. The 12 guiding principles are presented in three groups: over-arching goals; learning environment, content and experience; and monitoring progress.

## **Premises 1 and 2: Over-arching goals**

### **Premise 1. The child must learn to attach meaning to what is heard through the CI**

To learn a spoken language via a CI, two conditions must be met. First, the listener must have sufficient (not necessarily perfect) auditory access to the language code – the vowels, consonants, and suprasegmental patterns that make up that language. Put simply, a child must be able to hear a language in order to learn it. Think of an English speaker trying to learn Portuguese, for example, while being taught through a soundproof window. There is little chance that anyone could learn Portuguese this way. But even if a child has access to the sound and patterns of a language, a second critical condition must also be met: The sounds must gradually be attached to meaning. Attaching meaning to the sounds transmitted by a CI is a critical task, whether it is a postlingual child who must re-map the new signal onto an existing linguistic code or a child with pre-lingual deafness who must develop the code de novo. The CI and its technology provide access, but habilitation, parental follow-up, a nurturing auditory and spoken language environment at home and at school, and the child's own developing cognitive abilities create the opportunities for sounds to become meaningful. If meaning is not established, a child is unlikely to demonstrate functional benefit from CIs. In addition, the older the child at the he receives CIs, the more intensive and didactic the habilitation will need to be to ensure that sound becomes meaningful. For older children who have not heard before, habilitation becomes rehabilitation.

### **Premise 2. The ultimate goal for all children with hearing loss, including those with CIs, is communicative competence**

By communicative competence we mean that a child can understand and utilize human communication at a level consistent with his age and cognitive ability. Modes of communication for children with hearing loss are on a spectrum from highly oral to highly visual. Some children with CIs will learn to rely heavily on their listening abilities. For others, communicative competence will include the use of sign language or cued speech, either full-time or only in academic settings, or only for receptive clarification. There is an assumption, though, that if parents have sought CIs, they value their child's auditory and spoken language skills and intend to devote energy to improving them. Parents should be encouraged to select the options for their child that reflect the values they hold as parents, consistent with their goals for their child's future.

## **Premise 3, 4, 5: The learning environment**

### **Premise 3. If they are to be useful, skills learned in the therapy room must generalize into the classroom, home, and other aspects of the child's everyday world**

Clinicians must develop and practice skills within the therapy room but always with the greater goal that those skills will generalize out of the therapy room, into the child's classroom, home setting, and other everyday environments.

Parents are primary agents in their child's communicative competence and overall development, as we have learned from research and clinical experience. I believe clinicians are most effective when they view their role largely as one of helping parents facilitate their child's communication development day in and day out, within the scope of daily interactions and family life. For older children whose parents are not at school every day, it is especially important to convey the message that parents are essential to their child's success. Sharing of information between home and school has great benefit for all involved and can be accomplished in a variety of ways, including through a communication notebook that travels from home to school and back. It is helpful for parents to complete an interview such as the Children's Home Inventory for Listening Difficulties (CHILD) that reflects the child's auditory behaviors in the home.<sup>2</sup> Clinical experience suggests that strong parental involvement can sometimes negate the effects of a weak educational setting, whereas the reverse is far less likely.

### **Premise 4. Habilitation sessions should integrate goals of speech, language, perception, and pragmatics within an environment that has appropriate social/emotional context**

Clinicians often write habilitation plans that isolate different domains of communication, writing separate goals for the child in each of these domains. Through that process, we break apart the complex, unified phenomenon of communication into artificially separate pieces. Our challenge in rehabilitation is to address those goals but to do so in a way that integrates or reunifies the pieces into a whole. This is a goal that is not always achievable in every rehabilitation session. Sometimes we must practice and help a child over-learn a particular skill through a traditional drill method that is unlike natural communication. This is acceptable, as long as the clinician seeks to put that skill back into purposeful communication as soon as the child is capable. We seek to use what Fey has termed a "hybrid" approach to intervention, balancing structured practice with naturalistic interactions.<sup>3</sup>

### **Premise 5. Parents are the most potent influence on the child's progress**

Due to the identification of hearing loss in babies via universal newborn hearing screening (UNHS) in the United States and other countries, and the growing number of

children with hearing loss implanted as infants and toddlers, an increasing number of clinicians are serving this population. Some clinicians are not trained to work with babies or to provide services within a model of family-centered intervention. Such intervention focuses on the parents and the family as a whole, rather than on “therapizing” the child with a CI. Moeller et al<sup>4</sup> cite statistics from Dunst<sup>5</sup> that 2 h per week, perhaps spent in therapy, make up only 2% of a toddler’s waking hours, whereas everyday activities such as diapering and feeding occur at least 2000 times before the child’s first birthday. This statistic is a convincing statement about the power of families, rather than clinicians, to be the change agents in their child’s communication after cochlear implantation. Parents who take advantage of only 10 interactions each waking hour of a child’s day will have provided more than 36,000 teachable moments between ages 1 and 2 years.

## **Premise 6–10: Content and experience**

### **Premise 6. Almost all children with CIs require a combination of didactic instruction and incidental learning to acquire spoken language**

Prior to CIs, auditory development in children with profound hearing loss was thought of as auditory training. The implication was that deaf children needed didactic instruction to achieve each of the hundreds of listening skills that make up the hierarchy of auditory development. Professionals assumed that the child learned only what was directly taught to him. This was not an unreasonable assumption prior to the development of multi-channel CIs, given that many profoundly deaf children with hearing aids were pattern perceivers, able to recognize only patterns of auditory information rather than discriminate the fine temporal and spectral structure of speech. With today’s sophisticated technology, CIs provide the potential for deaf children to utilize incidental learning to an unprecedented degree. Incidental spontaneous learning is the way children with normal hearing (NH) acquire language and, theoretically, is the most efficient and natural way to learn a native language. Still, the signal provided by the implant is not a perfect representation; even CI recipients using state-of-the-art speech processing technology receive a degraded auditory signal. In addition, many children receive a CI after a period of auditory deprivation during which they have learned to process information visually. Even with the improved auditory signal provided by the CI, these children may need systematic and intensive training to reach their full auditory potential. Thus, both didactic instruction and incidental learning have advantages for the CI child. In general, the older the child is at the time of cochlear implantation, the more structured, didactic instruction is generally required in rehabilitation.

### **Premise 7. A diagnostic teaching approach to CI therapy yields the most benefit, both to children and to parents and teachers**

A goal of the diagnostic teaching approach is to identify what the child IS ABLE TO do and to adjust the level of

difficulty of tasks, constantly challenging the child and then evaluating the conditions that either enhance or impede learning.<sup>6</sup> This is in contrast to a traditional therapy approach in which goals are set for a child and in each session similar activities are used. The underlying assumption of a traditional approach is that, with continued practice over multiple sessions, a child will increase the accuracy of the skill—a “practice makes perfect” philosophy. This approach is reinforced by the way individualized education programs (IEPs) are usually written, often using a format such as, “Johnny will demonstrate x skill x number of times using a set of x alternative responses with x% accuracy.” In a diagnostic teaching approach the setting of appropriate individual goals is still critical, but the clinician uses the child’s performance during each session to determine what is needed in the next session. If a child is successful with an activity under quiet conditions in a session, the child practices it during the next session to reach a level of automaticity, then the activity is made more challenging in the following session. The clinician continually monitors which factors are favorable or unfavorable to the child’s learning, focusing prominently on the positive aspect of the question: “What are the things that help this child learn most efficiently?” A diagnostic teaching approach works well for a flexible and creative clinician who is willing to try new things, knowing that even if a particular technique is not successful with a child, something valuable has been learned—that is, what *not* to use. It is productive to team with the classroom teacher, sharing the factors that have been identified in therapy as being useful or challenging to the child in the classroom setting, and vice versa.

### **Premise 8. Content from a child’s educational program should be used as material in rehabilitation for maximum reinforcement and most efficient use of instructional time**

Whenever possible, it is advisable for the clinician to use vocabulary, concepts, themes, music, and other classroom materials within habilitation activities. This serves to reinforce what is being targeted in the school situation. For example, a seven-year old child with CIs may be studying the life cycle of butterflies in school. Within therapy, we may be working on recalling details from passages the child has read. It benefits the child if the therapist uses a story for this activity that shares the theme of butterflies. Such an approach provides the student with more instructional time on the subject, more exposure to the related vocabulary and concepts, and aids in the child in recognizing the connections between ideas that are presented in different settings. It also establishes a reciprocity, grounded in respect, between the CI clinician and the classroom teacher. Clinicians who assure teachers that their goal is to make the teacher’s job easier, not harder, will often build alliances with regular education staff that promote goodwill throughout the child’s years at the school. These alliances become all the more important as a greater number of children with CIs are fully included in regular education settings.

### **Premise 9. Music, a rich and complex auditory experience that supports listening and spoken language development, should be integrated into habilitation**

Research and observational reports indicate that children with CIs seek out and appreciate music to a degree that is qualitatively different from that of post-lingually deafened adults with CIs.<sup>7,8</sup> Clinical experience strongly supports the use of music as an integral component, rather than a separate domain, of rehabilitation with CI children. There are multiple beneficial effects of integrating music into a therapy session and encouraging its use at home including: articulation suprasegmental accuracy, language development, listening development, social skills and turn-taking, and cultural assimilation.<sup>9</sup>

### **Premise 10. Infants and toddlers with implants require an approach that is quite different from that for children implanted after this age**

The goal of habilitation with babies wearing CIs is not just to develop words or auditory skills. Wetherby has written: "Communication develops from the infant and caregiver sharing affective states, joint attention, and intentions. Communicative abilities that develop during infancy form the foundation for emerging language".<sup>10</sup> Clinicians should see their primary role as guiding and coaching parents to be the key language "teacher" in their baby's life.

### **Premises 11 and 12: Monitoring progress**

#### **Premise 11. Auditory milestones that have been established may be used to "red flag" children who are progressing at a slower-than-expected rate**

Research and clinical findings have documented the auditory milestones achieved by the average child with CIs during the first year of device use.<sup>11</sup> Three different groups of CI children reflect different pre-implant characteristics and show different patterns of skill achievement. When a child is identified as progressing at a slower-than-expected rate, red flags are raised and specific steps taken, allowing clinicians to intervene as early as possible and identify the source of the problem.

#### **Premise 12. Formal assessment tools, although important for monitoring progress, may paint an inadequate picture of a CI child's overall competence with spoken language**

For a variety of reasons, it is important to carry out formal assessments with children wearing CIs.<sup>12</sup> However, finely-tuned analyses of formal test results are warranted. It is the interpretation of the tests, and not the test results themselves, that may be misleading. Virtually all tests, with the exception of spontaneous language samples, are contrived measures of language that utilize such formats as

picture pointing of four pictured choices, they may bear little resemblance to real-life communication demands. Children with hearing loss who often have been tested repeatedly (and thus may receive repeated practice with artificial test formats) may perform well on structured tests that have a repetitive nature. Therefore, caution should be used when children with CIs score within the average range on test instruments because these instruments may not be sensitive to the more subtle and higher-level demands of inference, problem-solving, and topic shifts that characterize real-world conversation.<sup>13</sup> It is wise to augment the use of standardized tests with informal procedures, criterion-based evaluations, and, most importantly, spontaneous language samples. The latter represent the most accurate window into the real-world communicative competence of a child wearing CIs.

### **Summary**

These 12 premises are not an exhaustive inventory of all the factors important to issues of habilitation for children with CIs. Rather they represent, in the author's opinion, the most essential principles in a framework upon which a CI clinician may build an effective program for this population. The premises are based upon published research findings to date and upon the author's clinical experience over the past third of a century working with children using CIs. It is certain that ongoing developments in our rapidly-expanding field will bring new information to light, allowing even more effective habilitation to be offered to children and their parents. I look out onto the frontiers of technology and clinical science and can't help but imagine what astonishing innovations await, just over the horizon.

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