Bilingual Oral Language Usage in Children with Cochlear Implants: A Systematic Review

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Introduction

In recent years, cochlear implants have begun to become a more mainstream and realistic option for young deaf children. Improvements in surgical technique, speech processing strategies, and the device itself have all helped to make this a possibility for many families. While giving a child a cochlear implant does not restore the child’s natural hearing, it does give that child a better opportunity to develop spoken language. A popularly cited statistic among professionals states that 90% of deaf children are born to hearing parents. For typically hearing individuals with little or no knowledge of deafness, sign language, and Deaf culture, it is a natural response for parents to want their children to be able to develop the spoken language that they themselves use. As cochlear implants are now a safe and realistic option for children at a young age, many parents are turning toward cochlear implants as a tool to help their children develop spoken language.

In addition to cochlear implants, there is another widespread trend in the United States and abroad: bilingual children. Many children are raised by parents whose first language is not that of the country in which they are living, or who may speak multiple languages proficiently. In these situations, children will typically learn their parents’ first language, as well as the national language. Additionally, in some areas of the world, children learn multiple languages from birth. This is seen in the Philippines with English and Filipino, as well as in Belgium with French and Dutch. Learning multiple languages from a young age appears not to pose any problems, and research has shown that the younger a child is exposed to one or many languages, the easier it is for child to pick up the languages. Due to this theory, if parents hope to raise their children bilingually, it is natural for these children to be exposed to both languages from early in their lives. These children will learn to code-switch between the two languages, and may communicate with their families in one language, but socialize and be educated in another language. Children who grow up learning bilingual oral languages typically become proficient at both languages at an early age.
While prior research has shown that children who are raised with more than one language are able to become proficient in both languages, there was some concern that the second language would interrupt learning of the primary language, thus causing delays in both languages. However, now that more research has been done on bilingual children, this theory has been disproven for most children. While this is true, there is still a theory regarding the lag and catch up that many bilingual children experience. Children learning a second language or two languages simultaneously may show a lag in one language for a period of time, typically the language that is not spoken in their home. However, research has shown that these effects are temporary, and that these children eventually catch up to their peers in both languages in terms of developmental milestones which are experienced while learning language.

Knowing this information about children learning multiple languages, families of young children receiving cochlear implants have generally been discouraged from raising their children bilingually. Children who are receiving cochlear implants may have been exposed to a variety of spoken languages prior to receiving the implant; however, due to the severe nature of their hearing losses, these children are unlikely to have understood much of the language, and therefore may be delayed in spoken language and related developmental milestones even before receiving the cochlear implant. Intense therapy is needed following cochlear implantation, and the nature of the therapy lends better to using one language with the child. With this in mind, it is easy to see why families have been discouraged from using multiple languages after giving their child a cochlear implant. Professionals may counsel the parents that the child is already delayed in speech and language development and that following cochlear implant activation, exposing him to multiple languages could delay him further, something that most parents do not want to see happen. Many professionals may still subscribe to this theory, even with the more recent research that shows that bilingual children eventually acquire both languages.

Another potential issue surrounding bilingualism in children receiving cochlear implants is providing
these children with services. Children receiving cochlear implants need audiology and speech pathology services in order to maximize the benefit they will get out of their cochlear implant, as well as to develop their abilities to detect, discriminate, identify and comprehend sounds, which they have likely not been doing prior to receiving a cochlear implant. In the United States, the typical professional one would find at a cochlear implant center is working with the child using spoken English. Finding bilingual therapists to work with the child in more than one language could potentially be a difficult task for a family. Even with the increasingly common combination of English and Spanish, finding a bilingual speech pathologist or audiologist to work with the child on a regular basis would be challenging for the family.

There is a wealth of research that has been done on children who have received cochlear implants. Many different aspects have been explored, ranging from the surgical technique used to longitudinal studies tracking the development of production of specific consonant and vowel sounds. In addition, there is also a wealth of research which has been done regarding children being raised with multiple languages; however, at this time there is little information on how the two overlap. Children with cochlear implants using one manual and one spoken language have been studied, but studies on children with cochlear implants using two separate oral languages are few and far between. A critical review of the available literature on this topic is needed in order to examine the implications of cochlear implantation on young children using bilingual oral languages.

*Critical Review of Literature*

“Children with Cochlear Implants from Bilingual Families: Considerations for Intervention and a Case Study”

Guiberson’s article presents a literature review and case study focusing on the assumption that children who are deaf are unable to develop the skills necessary to develop bilingual oral languages. Guiberson
(2005) reports that recent research has shown that the patterns of oral language development for children with cochlear implants are comparable to their typically developing, hearing peers of the same language age. If this is indeed the case, as Guiberson believes, there is little reason to believe that provided with an environment that is rich in multiple languages, that children with cochlear implants would flourish any less than their typically developing hearing peers do in such situations. As the population of bilingual children with cochlear implants is limited at this time, the author chose to use a case study approach to determine whether a child with a cochlear implant would be able to develop bilingual oral languages.

Guiberson chose a young girl from a bilingual background who received a cochlear implant at five years of age, approximately three years after developing a severe to profound hearing loss due to meningitis. The child’s teachers and therapists focused on English language development, while her family facilitated her Spanish language development. The child had a rigorous therapy program, which made use of a variety of tools, including the *SKI-HI Resource Manual*, the *Functional Auditory Performance Indicators* (FAPI), the *Word Association for Syllable Perception* (WASP), and the *Speech Perception Instructional Curriculum and Evaluation* (SPICE). The child was evaluated at regular intervals to assess her speech perception and production skills. To do this, the *Early Speech Perception Test for Profoundly Hearing Impaired Children* (ESP) was used. This test involves a closed set measuring pattern perception and word identification scores within four categories ranging from little to no pattern perception to consistent word identification ability. During the time between 4 months and 41 months post-implant, the child steadily improved from level one (little to no pattern perception) to level four (consistent word identification ability). The child was also given the *Goldman-Fristoe Test of Articulation* and received a score which matched her hearing age of 3 years, 3 months. The author reports that at the close of the study, the child was developing academic and conversational English skills and conversational Spanish skills.
While it is clear that Guiberson has done a thorough job of developing a case study and assessing spoken language skills for a child with a cochlear implant, there are definite weaknesses within his case study. The greatest area of weakness is the level of evidence provided in this study. This study has an evidence level of III, due to the fact that it is a non-experimental case study. In addition, the case study did not involve multiple subjects, and thus results may not be generalized to any population. In addition, while the developing English language skills of the child are formally tested and reported on, the child’s Spanish language skills are evaluated only by family report, and not by any means of formal or standardized assessment. The child’s family reported that she was able to communicate with her family in Spanish, as well as do a few simple academic tasks such as counting in her second language, but no actual testing was done to confirm this. Despite the low level of evidence and the lack of formal evidence, this case study does have strengths. The literature review provided gives compelling evidence as to why it should be possible to educate children with cochlear implants in developing bilingual language proficiency. The case study also provides a solid basis for suggestions on how to work with a bilingual child who uses a cochlear implant. Finally, given that the general trend is for children using cochlear implants to be educated using only English, finding subjects for a study such as this one is currently difficult. This case study gives a solid baseline for what future studies will be able to do with larger groups in order to truly measure the ability for children with cochlear implants to develop bilingually.

“Second Oral Language Capabilities in Children with Cochlear Implants”

Waltzman et al (2003) performed a study in order to determine whether it was possible for children with cochlear implants to develop an age-appropriate competency in a second language while still maintaining age-appropriate receptive and expressive language skills in their first language. Waltzman et al felt that the development of other oral languages in addition to the child’s primary language would not impair their ability to communicate in their first language, regardless of cochlear implantation. The authors performed a study, using 18 profoundly, congenitally deaf children who received Nucleus 22 or
24 cochlear implants at five years of age or younger, who currently used oral language as their only mode of communication. These children were all identified as being bilingual language users prior to entering the study. Of the eighteen participants, English was the first language of sixteen participants. The remaining two participants identified Yiddish as their first language, and English as their second language. These children were also educated in bilingual environments, receiving instruction in both their first and second languages in school. In order to measure word and sentence perception, participants were given a variety of tests preoperatively and postoperatively. These tests included: *Glendonald Auditory Screening Procedure*, the *Phonetically Balanced Kindergarten Test*, the *Consonant-Vowel-Consonant Test*, and the *Multisyllabic Lexical Neighborhood Test* for word recognition, as well as: the *Common Phrases Test*, the *Bamford-Kowal-Bench Test*, and the *Hearing-in-Noise Test*. Subjects who were too young to understand or participate in the measures were initially given a score of zero.

More importantly, the children’s English language abilities were assessed using either the *Reynell Developmental Language Scales* (RDLS) or the *Oral and Written Language Scales* (OWLS), depending on age. Children younger than 4 years were given the RDLS, while all other children were assessed using the OWLS. The participants were assessed in their second languages using the *Student Oral Language Observation Matrix* (SOLOM), which assigns students a level from 1-5 in comprehension, fluency, vocabulary, pronunciation and grammar. To assess the children’s skills, they were observed conversing with a parent who was fluent in the child’s second language.

The results of the study showed that the majority of the children demonstrated age-appropriate receptive and expressive language skills in their first language, even comparing with their typically developing hearing peers. However, the results of the children’s second language measures were less conclusive, and the participants in the study ranged from categorized as early producers of their second language to advanced fluency in their second language. The study does reveal that this group of cochlear implant users demonstrated the ability to use a second language, if not necessarily to master it.
As in any study, there are both strengths and weaknesses to Waltzman et al’s study. This study does not have a particularly strong evidence level, as it is categorized as level IIb, since it is a quasi-experimental study. While the children who participated in the study were given measures before and after receiving their cochlear implants, there was no control group to measure the bilingual cochlear implant user group against in order to determine if their results are following patterns observed in other groups, either typically developing bilingual users or monolingual cochlear implant users. In addition, while the participants were assessed in both their first and second languages, there was no mention of the therapists administering the tests being proficient in one or both languages. If the therapists were English users only their ability to rate the children in their second languages could have been impaired.

Despite its weaknesses, there were several strengths to this study. First of all, the study used a good number of participants for the population being studied. In addition, the authors were able to assess both their first and second languages using formal, standardized assessments which makes comparison between the population studied and other populations easier to see. The authors also account for other possible underlying issues such as auditory skills, multiple disabilities, home language environment, parental involvement, school setting and language intervention which could have affected or altered their results. The authors are also explicit about the fact that this study is only a jumping off point for future studies to be conducted in order to truly examine the capabilities of children with cochlear implants to develop bilingual proficiency.

“Bilingual Oral Proficiency in Children with Cochlear Implants”

It has been debated whether it is ideal to expose children with cochlear implants to a second language while they are still developing a first language. Historically, this has been a challenging environment for deaf children with hearing aids because of the limited access they receive to these languages. With
cochlear implants today, children are receiving access to fine phonetic structures during the optimal period of language acquisition, and they are exposed to incidental, natural learning through their ability to overhear conversations. It is thus hypothesized that for those children implanted at an early age and living in a bilingual environment, acquisition of more than one language is possible and commensurate to hearing children in a bilingual environment.

This study followed 12 prelingually and profoundly deaf children with cochlear implants over a two year period, assessing their language skills each year. Of the 12 participants, six had genetic causes of deafness, and 12 were unknown, all were implanted with Nucleus 22 or 24 devices before the age of three, and all had been using the cochlear implant between 11 months and 12 years. Both before and after receiving their cochlear implants, all underwent extensive auditory therapy in English in programs, which included a great deal of parental involvement. All parents were proficient in English. Second language usage varied in intensity and context, as participants used the second language either in the home, at school, in therapy, or in community activities, such as church.

The children’s acquisition of English was assessed using the Reynell Developmental Language Scales (RDLS) and the Oral and Written Language Scales (OWLS) for older children. Their second language acquisition was assessed using the Student Oral Language Observation Matrix (SOLOM). Based on time of implantation, they were assessed after a one year period, and then again approximately one year later.

Results of this study indicated that the children had high levels of proficiency in their first language, and proficiency in their second language varied based on the amount of language exposure and time since implantation. The children who were most successful were those who used the second language both in and outside of the home. Results may be so high because of the intensity of auditory-oral therapy both
pre- and post-implant. The parents were fluent in both English and the second-language. The children demonstrated abilities similar to hearing children in becoming bilingual during the critical period of language development.

In this study, the parents were fluent in both English and another language, even though English was not their native language. As most parents were advised to speak only one language with their children, they began using both after seeing the rapid progression of their child’s English skills after implantation. Because these parents were fluent in English, speaking English only was an option. For those not fluent, however, it is critical to speak in the language in which they are fluent for optimal language development of the child. As seen in this study, children with cochlear implants are able to differentiate and acquire more than one language. Their level of proficiency in their first language was not negatively impacted by the addition of a second language. It must be additionally noted, however, that all participants were implanted before 26 years of age, a critical factor in successful language acquisition.

This study presented with a level of evidence IIb, as it is a quasi-experimental study. In this study, the participating children were tested two times in a two year period after they received their cochlear implants. However, there was not a control group, and measures on the children were not taken prior to implantation. A control group could have consisted of bilingual hearing or hearing aid users, or monolingual cochlear implant users. When testing the first and second languages, different test measures were used, so results may be skewed. Some strengths of the study, however, are seen in that multiple standardized tests were used to assess the children’s language. An adequate sample size was used with reliable and similar characteristics, and the fact that the children had varying lengths of cochlear implant use was taken into account in the results.

“Bilingual auditory and oral/verbal performance of Filipino children with cochlear implants.”
In the Philippines, the language of instruction in oral deaf education is typically English. The home environment more often tends to be a mixture of Filipino and English. As such, the children receive formal training in English, and informal learning of Filipino. This study was designed to measure the communication abilities of children with cochlear implants learning language in a bilingual environment, with the formal teaching of English, and the informal exposure to Filipino.

The participants of this study consisted of 13 prelingually and profoundly deaf children living in the Philippines. These children were the first 13 consecutively implanted children with MED-EL cochlear implants, as this was the only cochlear implant system available in the Philippines at the time of the study. All children had profound hearing losses greater than 110 dB, all were two to three years post-implant, and all were implanted and educated in the Philippines through auditory-oral or auditory-verbal modes. While the participants received their cochlear implants between the ages of 1;8 and 4;0, they were evaluated between 4;0 and 8;0 years of age. The etiology of deafness for ten children was rubella, one was Waardenburg Syndrome, and two were unknown.

The children were assessed at one point in time using the Evaluation of Auditory Responses to Speech (EARS) Test Battery, which included both subjective and objective measures. The test was available and used in English, and it was also adapted into Filipino, as it was only available in English and German. As the article used was presented at the 4th Congress of Asia Pacific Symposium on Cochlear Implant, the results were presented and represented with one subtest, the MTP word test. This test evaluated word perception, and answers in both Filipino and English were accepted, and results were informally evaluated. It remains unclear as to which language the test was administered, or of what precisely the test consisted.

Out of a 156 answers, 106 were given correctly. Of these spontaneous answers, 88 responses (80%)
were given in English, and 18 (18%) were given in Filipino. Upon request, the children were able to translate 38 (36%) of the responses given in English into Filipino. This indicates that of the total utterances, both spontaneous and elicited, the children were capable of using 53% in Filipino. While the children were able to comprehend and express themselves in both the formal language of instruction and the home and environment languages, or English and Filipino, they were more proficient in the formally taught language, English. For those children living in bilingual societies or as a minority where the home language is not the formal language used at school or in therapy, results indicate that they are able to acquire language much in the same manner as hearing children.

This study demonstrates both strengths and weaknesses, as would be expected. This is a quasi-experimental study with a IIb level of evidence. The children were only tested once, after implantation. There was no control group to which the bilingual cochlear implant children could be compared, which could have included monolingual children with cochlear implants, or bilingual hearing children. No norms were used in the study. The first language of the examiners, and their proficiency in using both English and Filipino is not discussed either, which could have impacted the results. It is unknown which language the examiners used during testing. In addition to these weaknesses, the study portrays various strengths. First, for the given population, the sample size was reasonable and fairly homogenous. When testing the children’s language, the authors used the same test for both the formally and informally taught languages. This test also contained both subjective and objective information, which leads to more accurate results. Results were provided in a relatively un-technical manner that can be easily understood.

Conclusions & Implications

After reviewing the four studies, it is evident that when fitted with a cochlear implant, a child raised in a bilingual environment can acquire more than one spoken language, much like as is expected of their
hearing peers. Thus, it follows that proficiency in the spoken language will rely on length of time using the cochlear implant, amount of exposure to the language, and the proficiency of the language model. The studies reviewed have shown all of these factors to have implications on the ability of a child with a cochlear implant to be able to learn multiple oral languages. While there will always be a variety of factors in each individual child which will affect their ability to learn a first language, let alone multiple languages, these factors are among the most important for children with cochlear implants hoping to learn more than one oral language.

The length of time using the cochlear implant and the age at cochlear implantation have a great effect on learning oral language in general, and the same appears to hold true for learning multiple oral languages. The length of time a child has been using a cochlear implant is synonymous with the amount of time they have had exposure to sound and oral language. As previously discussed, one factor which helps children develop language is that of incidental learning. A child hears what is going on in the world around them, and slowly begins to absorb and make sense of this information. A child who has been implanted at a young age and has now been using a cochlear implant for several years will have a greater opportunity to utilize incidental learning and will thus develop oral language more naturally than they would without this input. All of the studies used in this review examined participants who had received cochlear implants before they were five years old. These younger children are thus more likely to succeed in learning a primary oral language and, it appears from the studies reviewed, multiple oral languages as well.

The amount of exposure to a given language is also an important factor on an individual’s ability to master the language. Without any exposure to a language, an individual cannot be expected to learn it at all. Children are not able to master a language solely by watching that language being used over a television. Children need regular exposure as well as regular opportunities to interact in the language themselves in order to develop and master the language. In order to develop ability in bilingual oral
languages, children need regular exposure to both languages which they are learning. If a child is exposed to English at home and at school, but is exposed to Spanish at a grandparent’s house once a week, a normal hearing child would have difficulty learning Spanish, and a child with a cochlear implant would have even more difficulty. Due to the fact that young children are likely to still be adapting to having a cochlear implant and learning the meaning of the sounds and languages around them, they need a great deal of exposure in order to truly become proficient in more than one language. The studies reviewed here have shown that with more casual exposure, children may be able to use a second language, but will not likely mastered it.

Finally, the proficiency of the language model is an important factor. As previously discussed, the majority of service providers, such as speech pathologists and audiologists, who a child with a cochlear implant will see on a regular basis are monolingual, being English speakers in the United States. Due to this fact, the families of children with cochlear implants are sometimes encouraged to use spoken English with their children, rather than another language. This, however, does not help the child. If a child is exposed to English from a family that is made up of speakers whose primary language is Spanish, the child's grasp of the English language will not be as strong due to the weaker language models. On the other hand, if they use both Spanish and English at home, they may easily master the Spanish language, the first language of their family, but lag behind in English. Fluency in Spanish will provide the child with a much richer language model than imperfect English. If a family makes the decision that they want their child who has a cochlear implant to learn multiple oral languages, it is important for them to be sure that the child will be exposed to proficient language models from both languages. All of the studies reviewed here have shown that the children with cochlear implants were stronger in one language than the other, and one explanation for this could be weaker language models in one of their bilingual languages.

Overall, the four studies reviewed for this paper have shown that it is indeed possible for children with
cochlear implants to develop bilingual oral languages. However, none of the current studies in this field have used a control group in order to adequately compare this population to either monolingual children with cochlear implants, or bilingual children with normal hearing. It is also difficult to generalize the results to a larger population of children with cochlear implants due to the lack of information that is currently available. At this time, there are very few studies which have been done on bilingual oral language learning in children with cochlear implants. The studies discussed in this review consist of quasi-experiments and a case study. Due to the specifications of the population, it is not possible to conduct a randomized study. A control group, however, can be used for comparison. Furthermore, a longitudinal study would be beneficial in truly examining bilingual oral language development in children with cochlear implants over time. However, because of the narrow nature of this population, the current research is accepted as valid and reliable. In the future, as cochlear implants and bilingualism become more widespread, further research can be conducted with a greater sample size and higher level of evidence.

While there remains a need for further research on this topic, the results of the four studies reviewed indicates that children with cochlear implants raised in bilingual oral environments can indeed learn more than one language. Much like is indicated in research on hearing children acquiring two languages, children with cochlear implants need regular access to both languages from proficient language models. However, unlike their hearing peers, these children also need be good users of their cochlear implants. This requires both time and support to achieve. While children may be able to communicate in multiple spoken languages, it is likely that one language will be stronger than the other, especially during initial language development. This is typical for most children raised in bilingual environments. With appropriate time and resources, children with cochlear implants can begin to acquire skills in both languages with the hopes that the languages will eventually be mastered.

