

How Well Do Young
Children Using Cochlear Implants
Succeed in the Development of
Language, Speech and
Academic Skills?

What Are Current
Research Findings
Telling Us?

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Revised: July 2008

Please note: References are listed in the back of this booklet.

Prevalence of Cochlear Implantation.

In 2002, Ertmer reported that more than 7,000 children in the United States had received cochlear implants (CIs). Since that time, it has been estimated that worldwide tens of thousands of children with a profound hearing impairment have received cochlear implants (Galvin, Mok, & Dowell, 2007).

Effects of Early versus Later Implantation.

Today, children as young as one year of age are now frequently being implanted. Implantation of children in early childhood is thought to shortcut possible deprivation and avoids some of the effects of this condition during the critical period of language acquisition (Gantz & others, 1994; Moores, 1987). Generally, researchers have reported that the use of cochlear implants in early childhood leads to a shorter period of deafness and is linked to better performances than many children implanted later in childhood on measures of speech, language and reading (Miyamoto, Houston, & Kirk, 2002; Nikopoulos & others, 2004; Geers, 2006; James, Rajput, Brinton & Goswami, 2008; Nicholas & Geers, 2007). It has also been reported that children implanted before 3.5 years of age had evoked cortical responses within the normal range. These normal cortical responses were not seen in children implanted after 3.5 years of age (Sharma, Dorman, Spahr, & Todd, 2002).

Speech, Language and Educational Benefits of Cochlear Implants.

Studies of the improvements made by children fit with cochlear implants have been reported over a substantial period of time and continue today. Kirk (2000) reviewed results from early investigations and concluded that children using CIs develop speech perception and speech production abilities beyond those typically found in deaf children who wear hearing aids. Others have found evidence of doubling in speech intelligibility after a year of experience using CIs (Hasenstab & Tobey, 1991). Geers (2002) reported that children using CIs were superior to those deaf children wearing conventional or tactile hearing aids in speech perception and spoken sentence length. Pisoni, Cleary, Geers and Tobey (1999) concluded that *children with CIs show superior underlying sensory and perceptual abilities for speech and language after implantation, and their performances continue to improve over time*. Tomblin, Spencer, Flock, Tyler and Gantz (1999) found that substantial numbers of implanted children who were retested over seven years made significant improvements in some auditory, speech, spoken language and reading skills. Related studies by Waltzman, Cohen and Shapiro (1992), Gantz and others (1994) and Brown, Abbas and Fryauf-Bertschy (1994) supported findings that children using CIs have superior measures of speech

perception including sentence recognition. Investigators have also reported that the language acquisition of some children with CIs approach levels achieved by normal hearing children (Svirsky, Robbins, Kirk, Pisoni & Miyamoto, 2000).

The reading comprehension of children with hearing impairments was studied by Connor and Zwolan (2004) who reported that overall performances in reading development were enhanced by use of cochlear implants. Variables cited by earlier investigators, e.g. Geers (2002) reported to be related to the reading skills of children with cochlear implants were studied. The variables they reported to have statistical significance in the prediction of the subjects' reading comprehension scores were: (a) age at which the child received the cochlear implant, (b) vocabulary skills, c) preoperative residual hearing, and (d) socioeconomic status. Vermeulen et, al. (2007) also studied the reading comprehension of 50 children using cochlear implants. They reported that reading scores were significantly superior in children using implants than deaf children not using cochlear implants. However, the reading comprehension scores of the children using cochlear implants lagged behind those of normal hearing children.

Factors Related to the Success of Early Intervention: Intensive Training of the Child and Family Members in the Process.

Findings from a number of investigations have indicated that children implanted early in life, who received intensive auditory learning training programs, tend to show impressive gains on tests and measures of speech, language, and educational skill development (Mischook & Cole, 1986; Bertram & Pad, 1995; Geers, 2002; Fair, Louw & Hugo, 2001; & Moog, 2002). Researchers have consistently reported that a collaborative multidisciplinary team, in which family members are full participants, is important in the development of speech, language, and literacy skills in children using cochlear implants (Beiter, Staller & Dowell, 1991; Chute & Nevins, 2006, Geers, 2002). The importance of the mother of the young child using a cochlear implant in participating in an intervention program for language and speech development was studied by Desjardin and Eisenberg (2007). They reported significant relationships between mother child language skills and techniques mothers used to develop them in their children.

What Happens to Children Using CIs When They Are of School Age?

In 2002, Moog found that the majority of elementary school-aged children in her study who were implanted early, scored within the normal range for language and reading. Results from studies by Francis, Koch, Wyatt and Niparko (1999) revealed that 75% of children they looked at with CIs

were enrolled in full-time mainstreamed classrooms after one to four years of CI experience. A similar finding was reported by Daya, Ashley, Gysin and Papsin (2000) and also from information obtained from a national survey of 86 families of young children with CIs. Fifty-seven of the 86 families reported that their mainstreamed children were receiving speech-language services, 47 auditory-listening training and 23 audiological services (Flexer, Wray, Sommers & Hawks, 2003). Additional research completed by Daya, Ashley, Gysin, and Papsin (2000) found that children with cochlear implants who grew up in multi-lingual home environments were able to achieve the same speech perception and educational outcomes as the English-speaking children. This study's findings are consistent with those reported by McConkey Robbins, Green, and Waltzman (2004). Children implanted between ages 2 and 12 years were evaluated for their long-term outcomes by Spencer, Gantz and Knutson (2004). They concluded that the children typically had academic achievement scores within 1 SD of their hearing peers and 50% of the college-age eligible students enrolled in college. Further, the children tended to follow the vocational/educational patterns of their parents. Geers (2002) reported that speech perception and production and certain language tests scores were superior in children using cochlear implants who were trained in auditory and speech skills, when compared to a similar group of children using CIs who were trained to communicate in classes using Total Communication.

Bilateral Cochlear Implants: If and When Are They Helpful.

Although considered by some authorities as controversial (Berg, Catherine, Hurst, & Herb, 2007), some portion of young deaf children are currently bilateral users of CIs. In their investigation of 121 cochlear implant centers, only 1 of the 58 centers reported that they routinely implant children bilaterally; 63 centers reported that rarely or never do so, and 24 centers reported that they sometimes performed bilateral implants. According to the data gathered from the cochlear implant centers, 76% cited "parental pushing" as a reason for performing bilateral CIs. Bilateral implantation is thought to improve a child's localization abilities and improve listening performances in adverse conditions. The outcomes of bilateral CI use by 11 children ages 4 or older was studied by Galvin, Mok and Dowell (2007) who used measures of speech perception and measures of noise localization. Based upon data from 10 children, they reported wide differences in performances on these tasks. However, information obtained from parents of 8 of the children indicated that they perceived their child's listening performances in daily life improved after the second CI was implanted. Some findings have indicated that children who receive their second implant earlier in childhood have better speech recognition

abilities than children who receive their second implant at older age levels (Wolfe, et. al. 2007). Staff from the University of Indiana School of Medicine reported that bilateral cochlear implants in some children and adults can improve emotional well being and some cognitive and listening skills (Bichey & Miyamoto, 2008). Obviously, many additional studies of the outcomes of bilateral implantation are needed.

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