Parents’ Views on Changes in Their Child’s Communication and Linguistic and Socioemotional Development After Cochlear Implantation

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Our aim was to obtain versatile information on the communication and socioemotional development of implanted children in their everyday environment. We studied 18 children implanted unilaterally at the mean age of 3 years 4 months. All had normal nonverbal intelligence, but 8 (44%) had concomitant problems. Their parents filled out semistructured questionnaires at 6 months and then annually 1–5 years after activation. Parents reported a change from use of signs to speech, and changes in the children’s vocal behavior and spoken language development. They also reported that children had calmed down and showed an increased sense of self-confidence and safety with an expanded social life. The greatest changes started to take place 1 year after implantation. Five years after implantation, two thirds of children were judged to be as independent as their age peers. We conclude that changes in communication pave the way to benefits in psychosocial development after implantation.

The cascade of benefits hypothesized to follow cochlear implantation over time has been discussed by Summerfield and Marshall (1999). These benefits include enhanced auditory skills, use of an oral communication mode, and acquisition of useful levels of spoken language. Spoken language abilities enhance integration into mainstream primary education, better school achievement, social versatility, broader options for further education, better employment, and finally, improved social independence and better quality of life in adulthood. These areas comprise a wealth of aspects that are important to address in addition to the formal measures used at clinics in the assessment of outcomes of implantation (see Thoutenhoofd et al., 2005), and parents have been reported to expect changes in these areas as major outcomes of implantation (Archbold, Lutman, Gregory, O’Neill, & Nikolopoulos, 2002; Kelsay & Tyler, 1996; Nikolopoulos, Lloyd, Archbold, & O’Donoghue, 2001; Richter et al., 2000; Sach & Whynes, 2005).

Parental Expectations and Their Fulfillment After Implantation

Most research on the outcomes of pediatric cochlear implantation has focused on speech perception, speech and language development, and communication assessed by formal clinical methods. Only a fraction of all studies exploring the process and effects of cochlear implantation have focused on parental expectations regarding the outcome of implantation (Archbold, Sach, O’Neill, Lutman, & Gregory 2008; Dromi & Ingber, 1999; Ingber & Dromi, 2009; Nikolopoulos et al., 2001; Sach & Whynes, 2005; Weisel, Most, & Michael, 2006; Zaidman-Zait & Most, 2005), or, for example, parental concerns or stress (Archbold, Lutman et al., 2002; Spahn, Burger, Löschmann, & Richter, 2004; Weisel et al., 2006; Zaidman-Zait, 2008). In these studies, the greatest parental concerns have dealt with making the decision to implant and its long-term effects on the child, the safety of the implant operation, the technical reliability of the device, speech and language development, the appropriate educational setting and further education, and the child’s social integration. Parental
stress has also been found to be associated with concomitant problems and the lower communicative competence of children with impaired hearing (Hintermair, 2006), indicating that children’s problems also affect the quality of life of their parents. Research based on parental views provides ecologically valid and usually generalizable information on implant outcomes. Views and experiences of other families are useful for the parents to know both during the implant decision-making process and also later on if readjustment of expectations is necessary. To detect critical incidents in the life of children and their families and to provide effective practices in the form of appropriate and timely support, professionals in hospitals and schools need information on parental views on their child’s communication and socioemotional development.

Satisfaction with the effects of implantation depends on the nature and level of expectations that parents have. However, although parental expectations are often very realistic at the time of implantation, they often change over time as children acquire more listening experience with the cochlear implant (Nikolopoulos et al., 2001; Sach & Whynes, 2005; Spahn, Richter, Burger, Löhle, & Wirsching, 2003; Weisel et al., 2006). Weisel et al. (2006), for example, reported that parental expectations were highest during the period of implant candidacy and the first years after implantation. Parents often wisely adapt their expectations on the basis of their child's development. Good results give reason to expect even better outcomes in the future, and obstacles in the child’s development may give reason to lower expectations. Expectations also change in a more general manner than within single families. As experience has accumulated, with ever younger children being implanted and implant devices and methods used in implant surgery evolving, expectations have steadily risen since the 1990s (see, e.g., Cunningham, 1990; Kelsay & Tyler, 1996; Kurki, 1999).

Changing expectations pose challenges to outcome measurement; measures need to be flexible enough to tap changes in parental expectations and their fulfillment. Instead of using a prospective, longitudinal design, many studies on the outcomes of pediatric implantation have been carried out by using a cross-sectional design, and variation in the duration of the children’s implant use has often been very large. Additionally, many studies, although having a prospective repeated-measures design, have concentrated on relatively short-term outcomes of implantation in the areas of speech perception, communication, and speech and language development. Wider perspectives obtained by longitudinal follow-ups of parental views on the effects of implantation on their child, the family, the child’s socioemotional development, and quality of life can support new families both during their decision-making process, in early habilitation after activation of the implant, and several years after their child’s implantation. To set realistic expectations, and for counseling purposes, it is also important to know which changes usually take place at different times after implantation.

Change in Communication and Development of Spoken Language After Implantation

Some studies have explored parents’ satisfaction with their child’s habilitation, the outcomes of implantation (Archbold, Lutman et al., 2002; Archbold, Sach, O’Neill, Lutman, & Gregory, 2006; Huttunen et al., 2009; Nikolopoulos et al., 2001; Sach & Whynes, 2005), and quality of life after implantation (Archbold et al., 2002; Huber, 2005; Huttunen, Sorri, & Välimaa, 2003; Huttunen et al.; Nikolopoulos et al.; Sach & Whynes; Warner-Czyz, Loy, Roland, Tong, & Tobey, 2009). On the basis of parents’ views, researchers have reported improvement in the child’s speech perception abilities, improved communication, and encouraging development in speech and language (Archbold et al. 2008; Damen, Krabbe, Archbold, & Mylanus, 2007; Watson, Hardie, Archbold & Wheeler, 2008). However, depending on the sample of children, up to 20% of parents have expressed their, at least partial, disappointment with implant outcomes (Archbold et al., 2008).

Change toward an oral communication mode is often expected by the parents, and such change is an indicator of their children’s auditory and spoken language development. During recent years, some reports have explored changes of communication mode by means of either retrospective analysis or cross-sectional parental reports. For example, Watson,
Archbold, and Nikolopoulos (2006) showed that of the 176 children they studied, 83% of those implanted at less than 3 years of age, almost two thirds of those implanted at 3–5 years of age, and somewhat less than one half of those implanted at an age of 5 years and older were using oral communication no later than 5 years after implantation. Thus, their communication mode 5 years after implantation was significantly related to their age at implantation. A change of communication mode most often occurred 1–3 years after implantation, but sometimes it took place even as late as after 3–5 years of implant use. Watson and her colleagues also showed that the communication mode of some children later changed back to using signed communication. This was related to poor results in spoken language development or underlying language difficulty, for example. Watson, Hardie, Archbold, and Wheeler (2008) reported that in 113 of 142 families, the children had changed to oral communication, 20 children showed no change, and 6 children used more signs than speech 5 years after implantation. The reasons for these changes were either the parents’ decision to use the communication mode that was most effective or most beneficial for the child’s future, or simply a decision to use the communication mode that the child preferred (either oral or signed). More recently, Wheeler, Archbold, Hardie, and Watson (2009) showed that different communication approaches were utilized at various stages in the child’s development after implantation. Initially, the most effective communication mode was use of signs, but later on a gradual shift toward oral communication took place as the child’s spoken language abilities developed.

From study to study, certain background and outcome factors appear to be associated with acquisition of an oral communication mode. Younger age at implantation, for example, clearly provides the child with greater opportunity to develop speech perception and spoken language (Baumgartner et al., 2002; Connor, Hieber, Arts, & Zwolan, 2000; Nicholas & Geers, 2007; O’Donoghue, Nikolopoulos, & Archbold, 2000; Svirsky, Teoh, & Neuburger, 2004; Watson et al., 2006). Of outcome factors, spoken language development and speech intelligibility seem to be associated with use of an oral communication mode (Huttunen et al., 2009; Tobey, Rekart, Buckley, & Geers, 2004; Watson et al., 2008; Wheeler et al., 2009), and existence of concomitant problems seems to be associated with use of a signed communication mode (Huttunen et al.; Wiley, Jahnke, Meinzen-Derr, & Choo, 2005; Watson et al.; Wheeler et al.).

Changes of the main communication mode can be considered to be reflected even in the educational settings of implanted children. Archbold, Nikolopoulos, O’Donoghue, and Lutman (1998), Archbold, Nikolopoulos, Lutman and O’Donoghue (2002), Geers and Brenner (2003) and Geers, Tobey, Moog, and Brenner (2008), among others, have reported a growing tendency to provide oral education to implanted children in educational settings. Children with sufficient auditory capacity and speech as their main communication mode seem to attend school in a mainstream setting, and it may be hypothesized that the communication mode used in the educational setting, in turn, develops the child’s language and communication further. However, in order to detect any trends related to implanted children in mainstream settings and to be able to provide these children the support they need for good school achievement, these aspects need to be explored more with prospective studies.

Socioemotional Outcomes of Implantation

Fluent communication skills are also one prerequisite for good socioemotional development. A child’s hearing problems are not only a clear risk factor for spoken language development, they also cause difficulties in early social experiences and interaction mediated by language, especially when a child with impaired hearing is born to parents with normal hearing. Roughly 96% of parents who have a child with impaired hearing have normal hearing themselves (Mitchell & Karchmer, 2004). A vast majority of people in the child’s environment also have normal hearing ability and use spoken language as their communication mode. It is therefore understandable that many children with a hearing impairment have been observed to mature slowly in their ability to understand feelings and thoughts of other people (Edmondson, 2006; Peterson & Slaughter, 2006), in their social behavior, in their self-regulation skills, and in their self-esteem (see reviews by Ita & Friedman, 1999; Moeller, 2007;
Moeller & Schick, 2005). For example, Dutch children with impaired hearing \((N = 238)\) have been reported to have approximately twice as many emotional/behavioral problems as their peers with normal hearing (van Eldik et al., 2004). Recently, Dammayer (2010) studied 334 Danish children with a hearing impairment and found that the prevalence of psychosocial difficulties among them was almost four times greater than in children with normal hearing. Children with concomitant problems had three times as many socioemotional problems as those without concomitant problems. Poor sign language and spoken language abilities were associated with psychosocial difficulties. Dammayer concluded that good communication abilities, whether in speech or sign language, are essential for the psychosocial well-being of children with impaired hearing. There is a strong interplay between communication and socioemotional development also later in life. Most (2007), for example, showed that in a mainstream setting, good speech intelligibility promotes positive social and emotional feelings in teenage. Teenagers that were in individual inclusion and had better speech intelligibility rated themselves as feeling less lonely. They also had more coherence compared with teenagers with poorer speech intelligibility.

Some reports on the effects of implantation on children’s socioemotional development are also available. Positive changes in general functioning, self-reliance, and well-being; better social relationships with hearing siblings, other family members, and friends; and improved independence have been found in several studies (Archbold et al., 2008; Bat-Chava & Deignan, 2001; Damen et al., 2007; Huttunen et al., 2009; Incesulu, Vural, & Erkam, 2003; Wiley et al., 2005). For example, in their study of 181 children with a cochlear implant, Nicholas and Geers (2003) reported that the children had good self-competence in daily life at the age of 8–9 years after 4–6 years of listening experience with the implant. Most of the children studied had a good self-image and, according to their parents, they were also happy and communicatively and socially well adjusted. In that study, information was gathered from the children with a low-verbal self-report instrument and with a parental questionnaire. According to British parents, children with an implant have been found to be more independent, happy, and satisfied after starting to use the implant (Beadle, Shores, & Wood, 2000). Their sense of safety, self-esteem, and relationships within the family have also been rated very favorably. As the greatest area of change after implantation, increased self-confidence of the children has been reported by 77% of British parents \((N = 30;\) Archbold, Lutman et al., 2002). In a cross-sectional study, Finnish parents also reported beneficial effects of implantation in the areas of general functioning, self-reliance, well-being, and social relations (Huttunen et al.). Sahli and Belgin (2006) found no difference in self-esteem between 12- and 19-year-old adolescents with an implant and peers with normal hearing. However, in some studies, despite the benefits of implantation, some children with an implant perceived their psychosocial life less favorably than their peers with normal hearing (Huber, 2005), and children have been reported to need support in their social relationships and social acceptance (Boyd, Knutson, & Dahlstrom, 2000). Again, as also pointed out by Moeller (2007), there is a constant need for prospective studies on the psychosocial development of children whose intervention is started early.

It may be concluded that the effects of implantation are multifaceted in nature. To find average developmental paths, variance in development, and possible reasons for such variance, there is a clear need for prospective research that explores the outcomes of implantation in everyday life simultaneously in several domains. This is needed because auditory and spoken language development and changes in the communication and socioemotional development of these children clearly affect one another and the whole family.

The present prospective qualitative study was set up to explore parental views in ecologically valid settings: at home and in day-care and school environments. In a follow-up study, we employed a questionnaire that included both closed-ended and open-ended questions to explore parental perspectives up to 5 years after their child’s implantation. We sought information on the main communication mode of the child and the people surrounding him; ease of and changes in communication, speech, and language development; parental experiences and satisfaction with the outcomes of implantation; and change in the child’s socioemotional development. We operationalized socioemotional
development by asking the parents about the child’s behavioral changes, peer relations, and independence.

On the basis of the parental questionnaires, four main research questions were set:

1. How and when does the communication of the children and the people in their environment change after implantation?
2. How do the children progress in their speech and language development and how satisfied are the parents with this progress?
3. How and when does the children’s socioemotional development change after implantation?
4. Is the existence of the child’s concomitant problems or the achievement of functional hearing ability related to implant outcomes in the areas of communication and socioemotional development?

Method

Children and Their Families

The informants for this study were 17 families with altogether 18 children (11 girls and 7 boys), who were implanted unilaterally at the Oulu University Hospital implant center in Finland. A monolingual Finnish-speaking family environment was used as the inclusion criterion for the implanted children. Seven of the children (39%) were born as the first child in their family. At the end of the follow-up, that is, 5 years after activation of the implant, the children had, on average, two siblings (range 0–7). Four children in this sample had one or more siblings with a hearing impairment. In socioeconomic terms, most of the families would be described as middle class on the basis of the education and working career of the parents. The parents of the children gave their written informed consent to the study after the study protocol had been approved by the Ethical Boards of the University of Oulu and the Northern Ostrobothnia Hospital District.

All the children had a bilateral, prelingual, profound hearing impairment that had been diagnosed, on average, at the age of 1 year 2 months (Table 1). Despite careful examinations, the etiology of the hearing impairment had remained unknown in 11 (61%) of the children. One child had a hereditary, syndromic hearing impairment accompanied by a mild visual defect, two children had inner ear malformations, and four had a nonsyndromic hearing impairment due to a mutation in the GJB2 gene that encodes the connexin 26 protein.

According to medical records, the nonverbal intelligence of all the children was found to be within the normal range. Depending on the decisions made child by child, the Leiter

Table 1  Demographic information and details of the hearing and auditory performance of the children with cochlear implants

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
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<tbody>
<tr>
<td>Age at diagnosis of hearing impairment</td>
<td>18</td>
<td>1 year</td>
<td>7 months</td>
<td>5 months</td>
<td>2 years</td>
</tr>
<tr>
<td>Preoperative duration of profound HI</td>
<td>18</td>
<td>3 years</td>
<td>20 months</td>
<td>1 year</td>
<td>8 years</td>
</tr>
<tr>
<td>Preoperative PTA&lt;sub&gt;0.5–4 kHz&lt;/sub&gt; with HA (dB)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8</td>
<td>111</td>
<td>12</td>
<td>93</td>
<td>130&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Age at activation</td>
<td>18</td>
<td>3 years</td>
<td>20 months</td>
<td>1 year</td>
<td>8 years</td>
</tr>
<tr>
<td>PTA&lt;sub&gt;0.5–4 kHz&lt;/sub&gt; with CI (dB) at the hearing age of 5 years</td>
<td>18</td>
<td>30</td>
<td>6</td>
<td>24</td>
<td>45</td>
</tr>
<tr>
<td>Speech recognition score with CI (%) at the hearing age of 5 years</td>
<td>16</td>
<td>77</td>
<td>24</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td>CAP score at the hearing age of 5 years&lt;sup&gt;c&lt;/sup&gt;</td>
<td>18</td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>

Notes: CAP = Categories of Auditory Performance; CI = cochlear implant; HI = hearing impairment; HA = hearing aid.

<sup>a</sup>PTA<sub>0.5–4 kHz</sub> = pure tone average over the frequencies of 0.5–4 kHz (EU Working Group on Genetics of Hearing Impairment, 1996).

<sup>b</sup>No measurable hearing at the measured frequency area = 130 dB HL (British Society of Audiology, 1988).

<sup>c</sup>CAP scores (the scale ranges from 0–7): 4 = Discriminates at least two speech sounds (Ling’s test sounds) without speech reading, 5 = Understands common phrases without speech reading, 6 = Understands conversation with a familiar talker without speech reading, 7 = Can use the telephone with a familiar talker.
International Performance scale, Leiter-R, Wechsler Intelligence Scale for Children, third edition, Wechsler Preschool and Primary Scale of Intelligence—Revised, Test of Visual-Motor Integration, Terman–Merrill–Lehtovaara scales and/or Terman–Merrill–Hellström tests had been used to test nonverbal intelligence. Eight of the children (44%) had notations of one to three concomitant problems in their medical records, most often a developmental language disorder or slight problems with neurological development (e.g., slow development of gross or fine motor functions, balance problems, developmental verbal dyspraxia). Formal diagnoses were not necessarily made, but because of these problems, for example, physiotherapy, occupational therapy, or special education was provided for the children. Of the eight children with concomitant problems, four were girls and four were boys. Because the whole group of children we studied comprised 11 girls and seven boys, a greater proportion of the boys had concomitant problems compared with the girls. Because of this uneven distribution, the results are not presented by gender of the child in the Results section.

Preoperatively, the parents of nine children reported the use of one or two hearing aids (9 hr a day, on average, SD 3, range 3–13 hr), but none of the 18 children could recognize any speech even with amplification. After implantation, 10 children used a MED-EL Combi 40+ implant, first with a CIS-PRO and often later on with a Tempo+ speech processor, and 8 children used either a Nucleus CI24M or CI24R CS implant with a SPrint (and often later on with an ESPrit 3G) speech processor. The implants were activated at the average age of 3 years 4 months (median 2 years 9 months; Table 1). Fourteen of 18 (78%) children were implanted before the age of 4 years. This means that at the beginning of the 5-year follow-up reported here, the age of the children was, on average, 3 years, and at the end, 8 years. Two children were reimplanted because of a device failure that occurred at the hearing age of 3 or 4 years. Hearing age means the time elapsed from activation of an implant, that is, the time a person with a hearing impairment has had the possibility to hear with an implant. According to the parents, all the children used their implants regularly; from the time point of 6 months to 5 years after activation, the mean duration of daily use of the implant was 12 hr (SD 2, range 5–15).

The children’s devices were programmed so that from the hearing age of 6 months to 5 years, the mean PTA_{0.5–4 kHz} (pure tone average over the frequencies of 0.5–4 kHz; EU Working Group on Genetics of Hearing Impairment, 1996) was 31 dB HL, on average (SD 10 dB). The children’s speech recognition was regularly assessed during their visits to the hospital. Various children’s and adults’ speech recognition test lists (e.g., speech recognition test lists for Finnish 3- to 4-year-old and 5- to 6-year-old children and Isolated bi-syllable words of Jauhiainen, 1974) together with test procedures appropriate for their age and phase of auditory development were used. This means that either the recorded test lists were presented with loudspeakers in an auditory open set format where the child responded either by signs or by using speech, or the child was provided with four alternative responses in visual form and was asked to select the word presented by pointing to a picture. The speech recognition test results of the children who were followed up were obtained annually from 11 to 17 children (mean 15) of 18. The mean speech recognition score of the children was 63% (median 80%) after 1 year of implant use, 72% (median 74%) after 2 years, 75% (median 72%) after 3 years, 82% (median 83%) after 4 years, and 77% (median 86%) after 5 years of implant use (Table 1). The variance in the measures of central tendency of the scores, especially the means, was affected not only by the auditory development but also by the number of children tested at each follow-up point. The speech recognition results with the new implant of the two children who were reimplanted after 3–4 years after the first implantation were comparable with those achieved with the first implant. Judged by the parents 5 years after implantation, the mean Categories of Auditory Performance (CAP) score (Archbold, Lutman, & Marshall, 1995; Archbold, Lutman, & Nikolopoulos, 1998) of the children was 6.4 (median 7, SD 1.1, range 4–7 on a scale of 0–7). The CAP score is a practical one-digit index that describes the highest level of functional hearing in everyday life.

Information on speech therapy services was collected from the children’s medical records. During
the year immediately preceding implantation, 12 children (67%) had been examined by a speech therapist or attended speech therapy (mean 15 sessions, SD 20, range 3–66). After activation of the implant, almost all the children received speech and language therapy, most often twice a week on a regular basis. One to five years after activation, the mean number of speech therapy sessions received annually ranged from 51 to 65. Due to a shortage of services provided in their place of domicile, two children received speech therapy for only a few months after implantation. However, after 5 years had elapsed from activation, the number of speech therapy sessions received started to drop more generally. Some children were judged to no longer need speech therapy or there was a local shortage or total lack of speech therapy resources.

Procedure

Information on these 18 children and their families was prospectively collected with questionnaires sent to the children’s parents altogether seven times: preoperatively and at 6 months and 1, 2, 3, 4, and 5 years after activation of the implant. At the time point of 6 months after activation, the questionnaires were sent to 14 families (for one child the follow-up started 1 year after activation and for three families the questionnaires were not sent due to technical reasons in mailing). Demographic information was collected from the children’s medical records.

For the purposes of this study, a locally devised semistructured questionnaire based on literature and clinical experience with children with hearing impairments was created to monitor the effects of implantation. In the late 1990s, during the launching of the cochlear implant program at the Oulu University Hospital, no published or widely used questionnaires were available for exploring parental views on pediatric cochlear implantation. In the questionnaire used in this study, open-ended and closed-ended questions were included to explore, among other things, the main communication mode used by the child and the people in the immediate environment, reception of sounds and speech, vocalization, speech production and linguistic development, behavioral changes, peer relations, and independence.

Data Analysis

For the open-ended questions, data-based inductive content analysis was applied (see Carley, 1990; Krippendorff, 1980). The parents’ responses were coded into a manageable number of categories at the level of phrases and sentences. Coding was first performed independently by the two researchers. Differing views and interpretations that emerged in a small fraction of the data were then resolved by discussions. The results are presented as the percentage of all the responses for each theme that was found with the content analysis.

Results

From the preoperative phase to 5 years after activation of the implant, the parents filled out and returned altogether 112 questionnaires, from 14 to 18 at each time point, resulting in a mean response rate of 95%. The range of the response rate at different time points was 83%–100%. Because of occasional nonresponse to some questions, some questionnaires not being sent, and one child being recruited into the study 1 year after implantation, at different time points the data collected covers from 78% to 100% of the altogether 18 children studied. The questionnaires were filled out most often by the mothers alone (55%), in 33% of the cases by both parents together, and in 13% of the cases by the fathers.

Changes in Communication

Main communication mode. All but two of the children used only signs (signed Finnish or Finnish Sign Language) and all but three parents used speech and signs during the preoperative phase (Figure 1). The main communication mode of most of the children and their parents started to change during the first 2 years after implantation. Parents and children shifted to using speech instead of signing or using speech and signs usually approximately at the same pace. The same was true for the brothers and sisters of the children (Figure 2), whereas in most cases the communication mode of friends seemed to be speech at the different data collection points.

When we looked at the changes of communication mode in terms of the children’s demographic factors
and auditory development, the results revealed that 5 years after activation, 89% of the children with no concomitant problems (N = 12) used speech and 11% used speech and signs. Of the eight children with one or more concomitant problems (problems with motor development or a developmental language disorder), four (50%) used speech, three (38%) used speech and signs, and one (13%) used sign language. The CAP score obtained at the hearing age of 5 years was also indicative of the main communication mode of the children: 77% of the children scoring 7 (“Can use the telephone with a familiar talker,” the highest possible CAP score) used speech as their main communication mode, whereas only 33% of the children who had a CAP score lower than that used speech as their communication mode. At this stage, 13 of the 18 children were in school (Finnish children with a profound hearing impairment start school at 6 or 7 years of age), seven of them were in a mainstream setting, and six were in a special education setting. All the mainstreamed children...
children used speech as their main communication mode, two of the six children attending a special school used sign language, and four used speech. At different time points, 6–15 children were in day care outside their home. The day-care personnel of almost all the children (whose parents had replied to this question concerning the main communication mode) used speech and signs as their communication mode right before and during the first year after the child’s implantation (Figure 3). Speech was used more often than speech and signs from around 3 years after implantation onward. Most teachers of school-aged children used speech during the follow-up of the present study, although also speech and signs or sign language were used with some children who attended special schools.

In order to further explore the various aspects associated with the main communication mode, we also investigated the amount of instruction in signs that the families received before and after implantation. To reduce recall bias, we defined the target period to be the previous 6 months before receiving the questionnaire. The amount of instruction in signs that the families received was associated both with the change of communication mode and partly also with difficulties in getting services as indicated by the parents. Looking at the parental responses at all the data points, a mean of 40% (range 0–71) of the families reported having received instruction in signs during the preceding 6-month period. In 40% of the cases, the instruction received was in Finnish Sign Language and in 60% of the cases in signed Finnish. Instruction was given at home in a majority of the cases (73%). The mean number of sessions of sign instruction received within each half-year period was seven (median 0, SD 12, range 0–50). The amount of instruction in signs dropped after 1 year had elapsed from the child’s implantation: At the 2-year data point, the median number of sessions was down to 0 (Figure 4). The parents were also asked about their opinion on instruction in signs. At the different time points, learning Finnish Sign Language had been easy for 50% of the parents, and similarly, difficult for half of the parents. When it was perceived as difficult, the parents especially mentioned that syntax (word order) was challenging to learn. Additionally, the parents found it difficult to learn the signs and the use of facial expressions and to remember the signs learned. But, a mean of 79% of the parents learning signed Finnish found it easy at the different time points and only 21% found it difficult. Signed Finnish was perceived as easier, for example, because it could be used simultaneously with speech.

**Perceived ease of communication.** To further explore the parental views on changes in communication, ease of communication was surveyed with a closed-ended

![Figure 3](image-url)
question with six alternative responses ("communication has clearly gotten more difficult," "communication has gotten somewhat difficult," "no change," "communication has gotten somewhat easier," "communication has clearly gotten easier," and "communication has gotten very much easier"). On the basis of research literature, we expected more positive than negative changes to take place in communication after implantation. We wanted to explore more closely how strong these positive changes would be. That is why there were three positive responses and only two negative responses. Before implantation, the parents of only two families (14%) perceived communication at home with their child to be easy, nine parents (64%) found it rather easy, and three (21%) perceived it to be difficult. Compared with that information, it was somewhat surprising that the parents reported such clear improvement after implantation. None of the parents reported that communication had gotten more difficult or that no change had been seen. Instead, at the different time points, a mean of 61% of the respondents reported that communication had gotten very much easier, 28% reported that it had gotten clearly easier, and 11%, somewhat easier (Figure 5). Most of the parents had noticed that communication had gotten somewhat easier when 6 months had elapsed from activation of the implant. After that time point, the parents almost exclusively reported clear or very clear improvement in communication.

The parents were also asked about their opinion on their child’s communication at day care. Compared with the time preceding implantation, a change in perceived ease of communication in day care took place approximately 1 year after activation of the implant. Alternative responses, communication has gotten more difficult, no change, and communication has gotten easier, were given to the parents in this question. At the hearing age of 6 months, for three of the seven children attending day care and who had been in day care already preoperatively (43%), no change was noted in the perceived ease of communication, and for four (57%), communication had become easier. At the hearing age of 1 year, the parents of 11 of 12 children (92%) felt communication had become easier in day care, but with one child (8%) no change was seen. Later on, the parents of all 6–10 children attending day care outside their home perceived communication to have gotten easier in day care. According to the parents, communication with their child had gotten easier at the same pace in both day care and at home.

**Qualitative changes in communication.** In addition to closed-ended questions on changes in communication (see above), the parents were also asked about
qualitative changes in communication with an openended question. The parents gave altogether 163
descriptions (mean of 27 descriptions per time point,
range 21–34) of how communication with their child
had changed at home after implantation. Content anal-
ysis of the parents’ responses revealed five major
themes (Table 2). Enhanced use of an auditory modal-
ity was the most frequently mentioned change at all
time points. The parents reported that it was easier
to make contact with their child using voice and speech,
for example, by calling the child by name. They no
longer had to rely on only touching or visual means to
get the child’s attention. They further reported that
everyday life had become easier because the child
could be contacted from a distance. Use of an auditory
modality was gradually replacing the use of a visual
modality (signing), or the parents mentioned that
communication was starting to be supported by speech
reading (based on acquisition of spoken language).
Compared with references to increased use of audition
and the decreased role of a visual modality, mentions
of spoken language development were astonishingly
rare; they comprised only 15% of all the parents’
responses to this question.

In order to analyze which changes in communica-
tion emerged at which time point after implantation,
the major themes derived from the content analysis
were examined as a function of time. Some variance
in the share of observations representing different
themes was noticed (Figure 6). However, there were

<table>
<thead>
<tr>
<th>Theme</th>
<th>Percentage</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhanced use of an auditory modality</td>
<td>57</td>
<td>Child’s attention can be drawn by calling her name (female, HA 6 months)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parents can use tone and loudness of their voice in reading storybooks (male, HA 1 year)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Child hears speech from a distance (from another room or outside; female, HA 2 years)</td>
</tr>
<tr>
<td>Change in the use of a visual modality</td>
<td>19</td>
<td>Signs are no longer used with the child (male, HA 2 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Child signs only those words he wants to point out (male, HA 3 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Facial contact is not always needed in conversations (male, HA 3 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Child uses speech reading when she/he does not have the implant on (female, hearing age of 3 years; male, HA 5 years).</td>
</tr>
<tr>
<td>Spoken language development</td>
<td>15</td>
<td>Child imitates words a lot (female, HA 6 months)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Child commands others with his voice (male, HA 1 year).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Child can communicate mostly using speech in everyday life (female, HA 2 years), parents can use their native language in communication with their child (male, HA 3 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interactive conversations, also on abstract topics, are now possible (female, HA 3 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Child speaks intelligibly (female, HA 4 years)</td>
</tr>
<tr>
<td>Expanded social life</td>
<td>9</td>
<td>Child can communicate with strangers (who do not sign; male, HA 2 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Child is able to talk on the phone (male, HA 3 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communication between siblings/friends has eased/is successful (male, hearing age 3 years and male, HA 5 years)</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>3</td>
<td>Child has learned to sign and understand signing (male, HA 1 year).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Child does not understand speech he hears on a radio or TV (male, HA 3 years).</td>
</tr>
</tbody>
</table>

Note: HA = hearing age.
actually no distinct changes in parental views on changes in communication by time point because enhanced use of audition and a change in the use of a visual modality can be considered to represent different sides of the same process. Interestingly, observations on spoken language development started to emerge already 6 months after implantation, and mentions of expanded social life started to emerge at the data point 2 years after implantation.

Auditory and Speech and Language Development and Parental Satisfaction With It

To gather information for our second research question, the parents were asked about development of the auditory and spoken language skills of the children with an implant. According to the parents, the children started to recognize environmental sounds at the average hearing age of 2 months (SD 1.7 months), perceive rhythm of music at the average hearing age of 3 months (SD 3), recognize his or her own name (SD 3.5) and other words at 4 months (SD 4.1), and recognize sentences at the hearing age of 12 months (SD 9.4). Furthermore, the parents also reported an increase in the children’s vocalization 2 months (SD 2.0) after activation, on average; onomatopoetics emerged at 5 months (SD 3.9), on average; one- to two-syllable words emerged at 6 months (SD 5.0), on average; words of three or more syllables came at 10 months (SD 6.9); and two-word sentences appeared at 12 months (SD 9.4), three-word sentences at 14 months (SD 11.0), and inflection of words at 17 months after activation (SD 10.6). Variation in the parents’ reports was larger in the responses to questions on speech production than on speech perception.

Five years after implantation, the parents were asked with open-ended questions whether they were satisfied with their child’s auditory and spoken language development and whether their child’s development met their original expectations in these domains. With the help of content analysis, the parents’ responses were classified into three classes. Eight of the parents (44%) answered that their expectations were exceeded, seven (39%) felt their expectations were met, and three (17%) reported that their expectations were met only partly or not at all. When the parents were extremely satisfied with the implant outcomes, they especially emphasized the rapid progress of their child, the good quality of their child’s speech, and their child’s ability to cope socially with other people by using spoken language. The parents of three children expressed their disappointment in the slowness of spoken language development, either in the early phases of habilitation or during the whole period of the first 5 years after implantation. All these three children had at least one concomitant problem in addition to their profound hearing impairment. Additionally, one of these children with concomitant problems used speech and signs as her main communication mode 5 years after implantation, and according to her CAP score (which was 6), she understood conversation with a familiar talker without speech reading. In our study, age at implantation was not associated with parental satisfaction with spoken language development.

Socioemotional Development

In our third research question, we were interested in the children’s socioemotional development operationalized as changes in the child’s behavior, peer relations, and independence.

Changes in the children’s behavior. Using an open-ended question, the parents were asked if their
Child’s behavior had changed in some way after the implantation. Four examples were given in parentheses in order to clarify this question for the parents; whether “the child had calmed down” or “gotten more fidgety,” whether “the child had gotten more self-confident” or “less self-confident.” At each time point, the parents gave a mean of 28 descriptions (range 23–31) in response to this question. Content analysis revealed six major themes (Table 3). The parents most often mentioned an increase in their child’s self-confidence and sense of safety. This theme comprised altogether 34% of all the descriptions given by the parents in response to this question at the different time points. The other themes were expanded social life (27%), the child’s calming down (14%), change in vocal behavior (6%), and negative change in behavior (4%). No change or the view that the changes in the child’s behavior were probably due to maturation (increased age) was reported in 15% of the responses.

When the changes were analyzed separately at different data points, the child’s increased self-confidence was the most prevalent theme mentioned in the parental responses (Figure 7). Five years after implantation, there was a clear tendency of the parents to report increased self-confidence, especially in children with at least one concomitant problem compared with children without concomitant problems. In the parents’ responses, increased self-confidence was mentioned in 6 of 8 (75%) children with concomitant problems and in 4 of 10 children (40%) without concomitant problems. The main communication mode or functional hearing ability in everyday life (CAP score) was not related to parental reports of their child’s

<table>
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<tr>
<th>Theme</th>
<th>Percentage</th>
<th>Examples</th>
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</table>
| Increased self-confidence and sense of safety | 34         | Child is less timid (female, HA 6 months).  
                     |            | Child does not have to cease his play when he needs his mother, he has learned to call his mother (male, HA 6 months)  
                     |            | Child is more cheerful and trustful (female, HA 1 year)  
                     |            | Child is more self-confident and clearly makes more initiatives than earlier (male, HA 1 year)  |
| Expanded social life                      | 27         | Child asks questions and wants answers more than earlier (female, HA 3 years)  
                     |            | Child has stayed overnight at grandparents who do not sign (female, HA 3 years)  
                     |            | Child plays verbally with other children better than earlier (female, HA 3 years)  
                     |            | Child has a lot of friends and is always on the go (female, HA 4 years) |
| The child has calmed down                 | 16         | Child sometimes settles down to listen (male, HA 6 months)  
                     |            | Child has better concentration ability (female, HA 2 years)  
                     |            | Child has calmed down and is easier to guide (male, at HA 3 years)  |
| No changes or changes due to increased age | 15         | No big changes (female, HA 1 year).  
                     |            | Normal changes by age (male, HA 4 years).  
                     |            | Age brings big changes anyway, difficult to say what is related to implant outcomes (male, HA 4 years). |
| Change in vocal behavior                  | 6          | Child stopped yelling after implantation (female, HA 6 months)  
                     |            | Child uses his voice more (male, HA 1 year)  |
| Negative changes                          | 4          | Sometimes the child gets tired of listening and wants to take the processor off (female, HA 1 year)  
                     |            | Child is sometimes ashamed of her implant, other children stare at it (female, HA 3 years) |

Note: HA = hearing age.
self-confidence in any particular way at the 5-year data point.

Children’s peer relations. To obtain further information on the socioemotional development of the children in our study, the parents were also asked about the number of friends visiting their child weekly and the number of friends their child visited weekly. Annually, from 0 to 6 children (mean 2, SD 1.7) per week visited the implanted child, whereas the child with an implant visited, on average, 1.5 friends (SD 1.3, range 0–6) per week. The number of friends visiting the child per week remained rather constant over time, whereas the number of friends the implanted child visited weekly increased relatively evenly year by year and approached a mean of two friends by the time 5 years had elapsed from implantation. It is important to note, however, that both the age of the child with an implant and the place of residence of the family affected these figures. Children living in sparsely populated areas naturally did not have equal opportunities to see other children compared with children living in villages or cities. Additionally, if a child attended a special school far away from home from Monday to Friday, the possibilities of making friends with the neighborhood children during the weekends were few. This was particularly true for one child in our study. Furthermore, sign language used by this child did not make it easy to make contacts with neighborhood children. The children’s functional hearing ability in everyday life was also reflected in their social relations: At the hearing age of 5 years, the children with the lowest CAP scores were reported to have no friends or only one friend visiting them weekly, and they either did not visit other children at all or visited only one child weekly.

Children’s independence. Five years after implantation, the parents were asked to describe how independent their child was compared with age peers. To let the parents freely write their views, we did not operationalize this concept in any way in the questionnaire. Using content analysis, the parental responses were grouped into three categories: independence in activities of daily living (e.g. dressing and eating), communicative independence (child’s ability to rely on spoken language), and socioemotional independence (social tenderness/courage, ability to independently play with age peers). The parents of one child (6%) perceived this child as more independent than age peers. This child used sign language as the main communication mode. The parents of 12 children (67%) judged their child to be at his age level in independence. They mentioned, for example, the child’s independent functioning outside the home, independence in doing schoolwork, and ability to be alone without supervision at home after school, when necessary. The parents of five children (28%) reported that their children were less independent than their age peers. In these cases, the reasons were itemized as, for example, the need to confirm that the child has really understood what she has heard and what has been agreed on, or the child’s dependence on sign language interpretation because of insufficient hearing ability. Three of these five children who were rated by their parents as not being at their age level in independence used speech and signs and one used sign language. Eight children in this sample had concomitant problems. Three of them were rated as less independent than their age peers. Independence rated by the parents seemed to be somewhat related to the child’s functional hearing: Of the three children whose CAP score was more modest than that of the others (i.e.,
less than 7), two were rated as less independent than their age peers.

**Discussion**

The present study was a 5-year prospective follow-up of 18 consecutively unilaterally implanted children and their families concerning changes in communication, auditory and speech and language development, and changes in socioemotional development, assessed by means of parental questionnaires in everyday life. In this sample of children, we noticed that a major change toward the use of spoken language took place between 1 and 2 years after implantation. The communication mode of the parents and siblings of the implanted child changed accordingly. The parents also reported eased communication, increased use of audition, and a decrease in signing and dependence on eye contact in communication. Several socioemotional benefits were also detailed by the parents: The child's increased self-confidence and sense of safety, expanded social life, and positive changes in the child's behavior were most often mentioned. Five years after activation, a majority of the parents were satisfied or very satisfied with their child's auditory and spoken language development, and two thirds perceived their child to be as independent as their age peers. At this time point, the existence of at least one concomitant problem was often related to the main communication mode of the child, and functional hearing ability seemed to be at least somewhat associated with the child's peer relations and independence. With the small number of children, our results cannot, however, be considered conclusive.

Although it is sometimes difficult to compare the results of longitudinal data with those of cross-sectional studies reporting on outcomes of implantation from variable time points, our results on communication, auditory and spoken language development, and psychosocial development seem to be well in line especially with those of, for example, Chmiel, Sutton, and Jenkins (2000), Archbold, Lutman et al. (2002), Incesulu et al. (2003), Sach and Whynes (2005), Archbold et al. (2008), and Huttunen et al. (2009).

With our longitudinal study design, it was possible to explore individual profiles of the changes of the main communication mode of the children with an implant and of the people in the children's environment. In our study, the main communication mode of the children clearly started to change between 1 and 2 years after implantation. This result is similar to information found in the studies by Watson et al. (2006, 2008), Sume (2008), and Huttunen et al. (2009), in particular. For example, in the study by Watson et al. (2006), the children's communication mode changed between 1 and 3 years after implantation. In her longitudinal study of 15 Finnish children, Sume (2008) also found that children started to use speech as their main communication mode at the hearing age of around 2 years. Most of the children in her study were somewhat younger than the children in our study; they were usually implanted between 2 and 3 years of age. In a cross-sectional study of 36 Finnish children from several implant centers (Huttunen et al.), it was found that 67% of the children studied used speech as their main communication mode at 2 or 3 years after implantation (the children were implanted at the average age of 3 years 5 months). Speech and signs were used by 22% and sign language by 11% of the children. In the present study, we were additionally interested in changes of the communication mode of the people in the child's environment. One clear finding in our study was that the communication mode of the parents closely followed that of the children. Hence, it seems that the changes of communication mode in our sample were child led. This finding is quite well in line with the study by Watson and colleagues (2008) and Wheeler and colleagues (2009), who reported similar trends: As soon as the child's auditory and spoken language development allowed, the families changed to using speech.

The communication mode of the child is a rather straightforward and easily obtainable outcome of implantation, which is found to be associated with speech reception (O’Donoghue et al., 2000), language development (Cullington, Hodges, Butts, Dolan-Ash, & Balkany, 2000), speech intelligibility (Huttunen, 2008; Tobey, et al., 2004), and the educational setting selected for the child (Tobey et al.), among other things. In our study, the change of communication mode was also related to child-specific characteristics, namely the existence of concomitant problems and
functional hearing ability (CAP score). For example, three of the eight children with concomitant problems used speech and signs, and one used sign language as the main communication mode 5 years after activation of the implant. Moreover, 77% of the children scoring the highest level on the CAP scale used an oral communication mode 5 years after implantation. Clinicians, who consult new parents, while pointing out the rather wide variance often found in implanted children’s development, could use the time point of roughly 2 years after implantation as some kind of a milestone in the change of communication mode for children who have used signs or sign language before implantation. We base this view on our own results and accumulating similar data from other studies (see Huttunen et al., 2009; Sume, 2008; Watson et al., 2006; Watson et al., 2008). If a child’s main communication mode has not changed by that time point, it would be important to assess the functioning and programming of the speech processor, judge the need for more intensive habilitation, and explore whether possible underlying language difficulties could explain the child’s slow development. However, it is important to note that nowadays, especially if the children are implanted at a very young age (for example, before 18 months of age), parents may not adopt the use of signs at all because they expect the spoken language development of their child to be rapid. Additionally, children themselves may quite often acquire spoken language rather than signs. It has to be borne in mind, however, that variation does exist in children’s development, and use of signs may be important for some children.

It is obvious that the communication skills of children with impaired hearing usually develop with increasing age (Blamey et al., 2001). However, we can quite safely assume that the change of the main communication mode of the children in the present study resulted from their enhanced auditory function, not from age and maturation alone. Namely, in the study by Huttunen (2000) on Finnish children (N = 14) without a cochlear implant and who have a profound hearing impairment, 14% were observed to use speech; 8%, speech and signs; and 79%, sign language as their main communication mode. The average age of the children was 12 years. In the present data, the communication mode was speech in 70% of the children, speech and signs in 12%, and sign language in 6% of the children 5 years after activation. At that time point, the mean age of the children was 8 years. It has indeed been clearly shown that cochlear implantation provides profoundly hearing impaired children an effective way to acquire spoken language, and without an implant over time they would lag more and more behind their hearing age peers in spoken language development (Svirsky, Robbins, Kirk, Pisoni, & Miyamoto, 2000). However, we did not have a control group of children with a profound hearing impairment who used hearing aids, as some researchers have had. This is a clear limitation of our study. Such a group would be very difficult to recruit because, in Finland, nearly all children with a profound hearing impairment are implanted. Additionally, to be ultimately sure about the validity of our results, use of a control group of hearing children would have been important to enable us to show the share of socioemotional changes that were related to age and maturation rather than implant outcomes. In addition to information on child’s development given by the parents, use of objective measures is important. Recent reports (Lee, Chiu, van Hasselt, & Tong, 2009; Thal, DesJardin, & Eisenberg, 2007) have, however, shown that related to children with impaired hearing, parental reports on linguistic milestones correspond reasonably well with objective test measures.

In our study, the parents reported increased self-confidence in their children and a sense of safety as well as expanded social life, with an average of two children visiting the child weekly and the implanted child visiting about 1.5 friends weekly. The parents also judged 67% of the children to be as independent as their age peers when 5 years had elapsed from implantation. Stacey, Fortnum, Barton, and Summerfield (2006) have also reported improved social independence and socialization after implantation. Their large survey of more than 400 implanted children was based on parental and teacher reports. Wauters and Knoors (2008) studied 344 hearing children and 18 children with a severe or profound hearing impairment. Of these 18 children attending school in an inclusive setting, 9 used a cochlear implant. Hearing impaired children scored lower than their hearing age peers in
social competence, although the two groups did not differ from each other in social relations (peer acceptance and friendship relations). Children with an implant did not differ in these respects from children using hearing aids. Nicholas and Geers (2003) studied a large \((N = 181)\) group of implanted children and indicated that most of the children had a good self-image and were socially well adjusted. In both these studies, the children explored were attending school. Because educational options and emphasis on either inclusion or segregation of children with impaired hearing vary from country to country (Wauters & Knoors, 2008), research results on the impact of implantation on socioemotional development may rather strongly depend on the school system and traditional attitudes toward special populations in the child's living environment. Although a child with impaired hearing would develop good social skills, the values and views of people in the environment may lead to a situation where a child with a hearing impairment may not have friends at all or exhibits withdrawn behavior. In addition to the social competence of an implanted child and the values of the people in his environment, fluency of communication is also a key issue. Nunes, Pretzlik, and Olsson (2001) described some implanted children as being lonely, presumably because of communication problems between them and their hearing peers.

Several studies have reported that spoken language development is one of the major expectations of parents deciding to have an implant for their child (Nikolopoulos et al., 2001; Richter et al., 2000). We found that parental expectations regarding their child's auditory and spoken language development were met in 39% and exceeded in 44% of the cases. The combined figure of met or exceeded expectations (83%) is similar to that of many other studies (Archbold, Lutman et al., 2002; Archbold et al. 2008; Nikolopoulos et al.; Richter et al.). In the present sample, the degree of parental expectations met can be considered high if we bear in mind that 44% of the children had concomitant problems (many of which became evident only when several years had elapsed from implantation) and the average age of implantation was more than 3 years. To our mind, studying clinical samples of consecutively implanted children is of inherent value. With this kind of sample, it is possible to show effectiveness of implantation (effects of implantation in real, clinical samples and conditions). With selected samples, excluding children with concomitant problems, only the efficacy of implantation (i.e., maximal effects of implantation in optimal samples and optimal conditions) can be shown. We feel that the generalizability of results is more restricted in efficacy studies than in effectiveness studies.

Some background and outcome factors were related to the changes perceived by the parents, which may also partly explain the more modest development of some children we studied. For example, 5 years after activation of the device, a minority (parents of three children, 17%) was disappointed with their child's auditory and speech and language development compared with their original, retrospectively viewed expectations before implantation. All three children had at least one concomitant problem in addition to their profound hearing impairment. However, the parents of these children reported an increase in their child's self-confidence 5 years after activation. It seems that even if implantation does not enhance satisfactory spoken language development because of child-dependent factors, positive gains can still be achieved in the socioemotional domain. Auditory development may not always suffice for good spoken language development, but it may enhance development of a sense of safety, bring joy to the child, and give the parents the possibility to guide their child with speech.

Of the outcome factors, functional hearing ability (as judged by the parents with the CAP measure 5 years after activation) seemed to be associated with the children's social relations: The children with better hearing ability visited more friends weekly than did the children with more modest functional hearing. The children with better hearing were also visited by more friends per week than were those with a lower CAP score. It seems that improved hearing enhanced the child's integration into the hearing world, and it also improved the independence of the child. In many areas of sparsely populated countries like Finland, children with a profound hearing impairment rather seldom have signing people in their neighborhood. One child in particular in our sample deserves a closer look: This child with lower functional hearing ability
was dependent on sign language interpretation during the whole follow-up period, and she had no friends to visit and no friends visited her 5 years after implantation. The variation in age at implantation was rather wide (1.7–8.6) in our study. Because age at implantation was not associated with parental satisfaction with spoken language development, it seems that the parents of children who were implanted at an older age (4 years and older) had relatively low expectations regarding their child’s development.

About 30%–40% of all children with a hearing impairment are known to have at least one concomitant problem, most often learning difficulties (Fortnum, Marshall, & Summerfield, 2002), or problems in ophthalmic functions (Fortnum et al., 2002; Nikolopoulos et al., 2006), or in motor (Gheysen, Loots, & van Waelvelde, 2008) or neurological development (Schlumberger, Narbona, & Manrique, 2004). In our study, eight (44%) children had at least one other problem in addition to their hearing impairment. The existence of concomitant problems is known to be associated with more modest implant outcomes in spoken language development (Wiley et al., 2005). That is why, in the beginning, there were fewer children with concomitant problems among the implanted children than among children with hearing impairments in general (Fortnum et al.). However, important implant outcomes that improve the quality of life of both children and their families have also been reported in many studies on multihandicapped children (Berrettini et al., 2008; Wiley et al.). Because our study sample was comprised of consecutively implanted children from monolingual families, but was unselected in all other ways, our study results can be generalized to many clinical samples of unilaterally implanted children. However, after the launch of universal hearing screening of newborn children, the age at diagnosis of severe and profound hearing impairments and the age at implantation are nowadays expected to be lower than in our study. In that respect, our results may not be fully representative of children receiving a cochlear implant today.

Studies on the outcomes of implantation rather often report data of heterogeneous groups of children using cross-sectional study designs. Age at implantation, the age of the children studied, duration of implant use, and follow-up periods may vary in the same study even up to 10 or 15 years. In our prospective study, the length of the follow-up was 5 years for all but one child (for whom it was 4 years), and we were therefore able to obtain information and combine the strengths of both cross-sectional and longitudinal analyses. Our self-constructed measure was developed in the late 1990s, when no valid, reliable questionnaires had been published for measuring changes in communication and quality of life after implantation. Although the validity and reliability of our measure has not been explored, it was constructed on the basis of information on main implant outcomes published in scientific papers and clinical experience in communication and psychosocial development of children with impaired hearing. Additionally, our results are so concordant with those on parental views published in other countries that we expect our questionnaire to have tapped important issues in the development of implanted children. Other studies have also used qualitative research methods, for example, interviews (Bat-Chava & Deignan, 2001; Sach & Whynes, 2005; Sume, 2008; Wheeler et al., 2009; Wiley et al., 2005) and open-ended (Archbold, Lutman et al., 2002; Kelsay & Tyler, 1996) and closed-ended questionnaires (Archbold et al., 2008; Nikolopoulos et al., 2001), which provide nonrestricted insights into parental opinions, but which are very time-consuming in terms of both research and clinical work. Nevertheless, qualitative research is mandatory in order to obtain direct information from parents and children with implants. Because of changing interventions and changes in society, versatile information on emerging new phenomena can often be obtained only with open-ended questions. All levels of human functioning, as specified by the ICF classification (International Classification of Functioning, Disability and Health; World Health Organization, 2001), can also be measured effectively especially with qualitative research.

We need to consider whether our results would have been the same if it would have been possible to ask the children themselves. In some studies, the perceptions of parents and their children with a hearing impairment have not always been very concordant. Before the era of cochlear implants, Gregory, Bishop, and Sheldon (1995, p. 265), for example, reported that
most young people with impaired hearing (using or not using a hearing aid) perceived themselves to be happiest in secondary school, whereas their parents viewed them to be happiest in primary school. Additionally, the views of young people and their parents differed on the number and quality of social contacts; parents had a more pessimistic view of their child’s social life than did adolescents or young adults themselves. Some differing views have also been found between parents and their children on the advantages and disadvantages of the implant (Cunningham, 1990), education, social relationships (Chmiel et al., 2000; Huber, 2005), and quality of life (Nicholas & Geers, 2003; Huber; Warner-Czyz et al., 2009). Therefore, the children’s own perceptions should also be asked with appropriate and valid instruments as soon as the children are able to answer questions about communication, socioemotional development, and quality of life. To date, unfortunately, no consensus has been reached on the minimum age of children studied with self-report instruments and on appropriate measures to be used (Warner-Czyz et al.). It is important to use low-verbal instruments with younger children and with children with low communicative competence. Some reports concentrating on the views of adolescents with cochlear implants are fortunately already available (Huber; Wheeler et al., 2009; Leigh, Maxwell-McCaw, Bat-Chava, & Christiansen, 2009). In studies that look at children’s development, teacher reports are also very helpful in getting a more versatile view.

Our study covered the first 5 years after implantation until, for more than two thirds of the children, the first years in school. Summerfield and Marshall (1999) outlined the cascade of benefits of implantation affecting the child’s life into adulthood. For a majority of the children we followed up, implantation enhanced spoken language development based on auditory information and brought many positive changes in the socioemotional domain as well as the possibility for inclusive education—a new option in primary education in Finland for children with a profound hearing impairment. Given the challenges of advanced language levels needed in learning, school as a social environment, and identity formation in teenage, further research on communication and socioemotional development after implantation is warranted.

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**Conflict of Interest**

No conflicts of interest were reported.

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