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Cochlear Implants in children: Development in interaction with the social context

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Cochlear Implants in children: Development in interaction with the social context

PROEFSCHRIFT

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klokke 15.00 uur

door

Catharina Henrica Wiefferink

geboren te Denekamp in 1959

Promotiecommissie

Promotoren: Prof. Dr. C.R. Rieffe
Prof. Dr. J.H.M. Frijns

Overige leden: Prof. Dr. H. Knoors
Dr. A. Hoetink
Dr. E. Gerrits
Prof. Dr. E. Mylanus

Stille liedjes hoor ik graag

Dit denkt een doof klein meisje:

Ik kan je niet verstaan als je zo hard praat.
Dus ik begrijp er niks van en jij wordt kwaad.
Schreeuwen is een raar gezicht,
raar gezicht.
Dus doe die mond met tanden
maar gauw weer dicht.

De storm beweegt de bomen met veel gezwaai.
Wat heb ik toch een hekel aan dat lawaai.
Geef mij dan maar dat bloemenlied,
bloemenlied,
waarop je soms een vlinder
dansen ziet.

Ik weet nog van een keer dat ik slapen ging,
en moeder zong een liedje van lieveling,
o zo rustig en zo stil,
o zo stil
dat ik het nog kan horen
zo vaak ik wil.

Willem Wilmink

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Chapter 1

Introduction

Introduction

Approximately one newborn in a thousand has hearing loss at birth; in the Netherlands about 150 children yearly (Korver, Konings, Dekker, Beers, Wever & Frijns, 2010). Besides a serious impact on children's daily functioning, developmental opportunities and social interactions, deafness also seriously affects the position of these children in their direct social environment – not only in their family, but also in a wider societal context, such as school (Spencer & Marschark, 2010).

Due to impressive technical developments regarding cochlear implants (CI), the prospects for deaf children have changed since the 1990s. Nowadays, almost all children eligible for CI in the Western world receive such an implant, usually before the age of two (De Raeve, 2010), and for most children around their first birthday. A CI is a device that electrically stimulates the auditory nerve, bypassing the damaged part of the ear. A microphone transmits sounds to a speech processor, which converts them to electrical pulses that are then transmitted to the auditory nerve through electrodes on an array implanted in the cochlea. Ultimately, signals from the auditory nerve are perceived as sounds by the brain. However, whereas a normally functioning ear has close to 30,000 nerve endings that process sounds, a CI has only a limited number of electrodes that can stimulate the auditory nerve – currently a maximum of 22 (Wilson & Dorman, 2008).

In other words, a CI gives children access to sound, but not to an extent that makes them equal to children born with normal hearing, because the quality of the sound is not nearly as good as in hearing people. Despite this, studies on the effects of CIs in children show a positive influence on speech recognition, speech intelligibility and other aspects of spoken language development and also on reading comprehension compared to deaf children without a CI (Schauwers, Gillis, Daemers, De Beukelaer, De Ceulaer, Yperman & Govaerts, 2004; Svirsky, Chute, Green, Bollard & Miyamoto, 2002; Thoutenhoofd, Archbold, Gregory, Lutman, Nikolopoulos & Sach, 2005; Vermeulen, Van Bon, Schreuder, Knoors & Snik, 2007; Niparko, Tobey, Thal, Wang, Quittner & Fink, 2010; Boons, Brokx, Dhooge, Frijns, Peeraer, Vermeulen, Wouters & Van Wieringen, in press). However, individual outcomes have been shown to vary widely at implant centers around the world (Peterson, Pisoni & Miyamoto, 2010). While certain factors are known to have a positive influence on language development – such as a young age at implantation, the absence of other disabling handicaps, and involvement of the parents – it is uncertain how other factors, such as cultural and social factors, affect the daily functioning and development of children with a CI. Moreover, little research has been conducted on other aspects of development, such as emotional and social functioning in daily life.

In this context, there is still little literature on the effect of children's deafness and their CI on their development. If the best possible support is to be provided to these children (and their parents), and if they are to be offered an environment in which they can develop adaptively, with the best possible opportunities to deploy their capacities, the effects of a CI on their daily functioning should be understood in the greatest possible detail. This requires close examination of the different layers in their daily environment. Through fuller insight into the influence of child characteristics and environmental factors on CI children's daily functioning and development, it will be possible to provide more specific information on how their rehabilitation and counseling – and that of their parents – can be improved.

This thesis thus examines how a CI affects young children's daily functioning. The age of the children was between 1–5 years. All CI children were born to hearing parents, had profound prelingual hearing loss with no other disabling conditions, and all had had their implant before the age of 43 months, with one exception, who had received it at 57 months (range = 6–57 months). Within the framework of Bronfenbrenner's social-ecological model (1979), it explores the effect of a CI on young children, and various factors whereby this effect might be determined. While the framework describes influences on a child's development from different circles of its social context, this thesis focuses specifically on three topics that are all equally important to understanding and enhancing the daily functioning and development of children with CI:

1. The influence of parents on these children's daily functioning,
2. The influence of language mode on their language development,
3. The influence of a CI on their social-emotional functioning.

Social-ecological model

While child characteristics such as intelligence, temperament, and physical health are very important factors in children's daily functioning and development, this is only one side of the coin: the environment in which they live and grow can be equally important. The environment includes not only the immediate settings of the developing child, but also the wider social contexts in which these settings are embedded (Bronfenbrenner, 1979).

Bronfenbrenner's social-ecological model describes human development from an interactive contextual perspective, proposing that a child is at the center of a series of concentric circles, each representing a setting that influences him or her bi-directionally (figure 1). While the rings further away from the child represent societal values and culture, those that are closer represent settings on a smaller scale, such as family, neighborhood, and school. The inner circle represents the child's development: language development, social-emotional development, cognitive development and physical development.

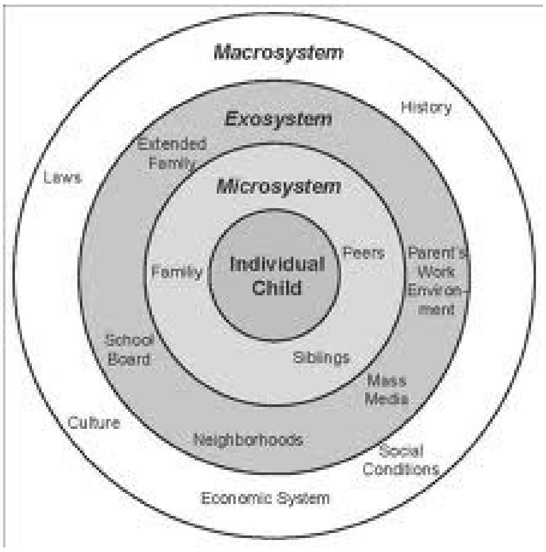

Figure 1. Bronfenbrenner's social-ecological model

A child's development is influenced by factors at all levels of the model, the most direct influences lying in the quality and quantity of the child's interpersonal interactions with family, peers, teachers, and others. Indirect influences come from the interrelationships between the settings in which the child is an active participant – such as home, day-care centre, and hospital – and the broad ideological, political and cultural patterns of the society in which he or she participates.

The environment of deaf children with a CI is very different from that of hearing children, even to that of their hearing siblings. In the immediate social context, they experience problems in communicating with others, for until they receive their CI they lack any access to spoken language. In the wider social context, too, their environment differs from that of hearing children. For example, rather than going to a mainstream school with their siblings, some may go to special schools for deaf children, where they learn sign language and may eventually become part of deaf culture. They also have to go through a very intensive rehabilitation, such as fine-tuning the sound levels for the speech processor, aural rehabilitation to help children interpret sound in their environment, and speech therapy for facilitating listening skills and speech skills.

It is therefore beyond question that these children's development is influenced by the context in which they are raised.

Parental influence on CI children's daily functioning and development

Parents' influence on the development of their deaf child should not be underestimated. In general, all parents are faced with decisions they have to make on their child's behalf: young children cannot decide on the daycare center they will attend or the clothes they wear. Most parents who discover that their child is deaf have to deal with a condition with which they are barely or entirely unfamiliar. Consequently, even though they know little or nothing about deafness and its consequences on children's daily functioning, they have to make decisions that will have a great impact on the child's future.

Shortly after the diagnosis, when their child is around three months, parents are already faced with the question of whether their child should receive a CI, and at what age. Due partly to the complexity of determining what they believe to be in the child's best interest – a process that is itself influenced by their values and beliefs – this is a difficult decision (Li, Bain & Steinberg, 2004). But it will be only the first step of many. There will be many other crucial decisions to make – whether they will communicate with their child in sign language or spoken language, for example, or whether he or she will go to a mainstream school or a special school for the deaf.

In short, parents have to make many decisions that will greatly influence their child's development and future. Some of these have to be made in the first year of the child's life, when most hearing parents of deaf children – i.e., 90-95% of prelingually deaf children – experience the feelings of loss and sadness that accompany the discovery that their child is deaf. As with the decisions they have to make, these feelings may cause them considerable stress (Hintermair, 2006). This may in turn influence the way they cope with the child's deafness, which may itself influence the child's development. Moreover, as stated above, parents are affected by factors from the wider social context that indirectly influence the development of the child (Bronfenbrenner, 1979).

According to the social-ecological model, the development of children is directly influenced by parent-child interaction. Research on the quality and quantity of the interaction between parents and their deaf child without a CI shows that parents of deaf children generally have difficulties interacting with their child: mothers interact with them less positively and less flexibly, and are less sensitive to their needs (Meadow-Orlans & Steinberg, 1993). Similarly, deaf children with hearing parents usually spend less time communicating with their parents, and cannot overhear conversations in which they are not directly involved (Gray, Hosie, Russell, Scott, & Hunter, 2007). Parents – who are used to interacting with others by means of spoken language – may have problems finding other ways to interact with a deaf child. Due to communication problems, they are therefore likely to have difficulties connecting with their child.

In short, the quantity and quality of interactions between parents and deaf children are insufficient, and in turn, negatively affect various aspects of children's development even in young children with a CI (DesJardin & Eisenberg 2007). While many children with a CI later have access to spoken language, they are deprived of it before they receive their CI, usually in the first one or two years of their life. In other words, the development of children, who have access to spoken language after receiving their CI is likely to be delayed, not only with regard to speech and language development, but also to other facets of development.

The qualities of the interrelationships in settings in which children participate indirectly influence the children's development. For those with a CI, most research on this topic has covered the influence of parental involvement in rehabilitation programs on the children's language development (Sarant, Holt, Dowell & Rickards, 2009; Moeller, 2000; DesJardin & Eisenberg, 2007). These studies showed that parent's involvement in rehabilitation programs is related to language development, greater parental involvement in these programs positively influencing the development of their child's spoken language development. It was also shown that parents from higher socio-economic background are usually more involved in the rehabilitation of their child than those from a low one (Niparko, Tobey, Thal, Wang, Quittner & Fink, 2010). However, less is known about the specific reasons why some parents' participation is low, especially in parents of minority groups.

Parents' values and beliefs – and, indirectly, their child's development – are influenced by their wider social context, such as ideological, political and cultural patterns in society. Within any society, these patterns differ per socioeconomic, ethnic, religious and sub-cultural group, each of which reflects contrasting belief systems and lifestyles. Because most studies on the development of children with a CI focus on a general population, little is known about that of such children in ethnic minority groups and about the influence of their parents' values and beliefs on this development.

Two studies from the USA found that such children benefit less from a CI, either because their parents have less access to healthcare facilities (Stern, Yueh, Lewis, Norton & Sie, 2005), or because they find it difficult to decide on the care of their deaf child (Steinberg, Delgado, Bain, Li & Ruperto, 2003). Such problems may be rooted in cultural differences: healthcare systems are usually tailored to the needs of the native population, which may differ from those of minorities. In the Netherlands, access to health care facilities is equal for all documented inhabitants, but immigrants from non-Western countries often experience problems in health care due to cultural differences and language problems (Yumusak & Hoogsteder, 1999) . In the Netherlands, over ten percent of the population consists of immigrants from non-Western countries. Research showed that the spoken language development of deaf children of Turkish origin is delayed compared to that of native deaf children (Wiefferink, Vermeij, Van der Stege, Spaai & Uilenburg, 2008). Because very little is known about the interrelationship between the dominant cultural values in Dutch society and the ways in which parents in ethnic minorities cope with a deaf child, how they make decisions on its rehabilitation, and how their coping and decision-making are influenced by cultural factors, an exploratory study was conducted in order to comprehend the nature of the delay in spoken language development.

Influence of language mode on the language development of children with a CI

Children's development depends largely on their interactions with their parents, siblings, teachers, peers, and with the other people they meet on a daily basis. Sufficient access to language is a prerequisite for interaction with others. Before the era of CI, sign language was considered to be the natural language for prelingually deaf people (Thoutenhoofd, Archbold, Gregory, Lutman, Nikolopoulos & Sach, 2005). During the 1980s and 1990s, many countries acknowledged that it was the only language deaf children could acquire in a natural way. Some of these countries – especially the USA and Scandinavian countries – thus implemented education in sign language, which in Sweden, for example, was declared an official language in 1981 (Preisler & Ahlström, 1997).

To date, sign language is still not legally recognized in the Netherlands, although its value is certainly acknowledged: in 1998, all major schools for the deaf established "bilingual" programs, i.e., programs for both oral and sign language (Knoors, 2006). In the 1970s, the Dutch Foundation for the Deaf and Hard of Hearing Child had already introduced a bilingual program for infants and their parents. The philosophy was that parents communicate better with their children if they learn the natural language for prelingually deaf children, and that communicating in children's natural language will contribute positively to these children's development. The use of sign language in deaf children and the implementation of bilingual education in pre-schools and schools thus grew out of the wider social context. As a result, these children's immediate social context is at least partly bilingual, which directly influences their development.

In daily practice, however, there are still various imperfections. Deaf children with hearing parents are much less skilled in sign language than deaf children with deaf parents (Mayer & Leigh, 2010). The reason is assumed to lie in the fact that neither parents nor teachers are native signers, whose mastery of sign language is often insufficient to communicate in a more mature way. This particularly affects their ability to talk about the past and future, but also about abstract concepts such as emotions or thoughts.

Since an important goal of cochlear implantation is to understand speech in everyday listening environments and, as a result, the ability to acquire spoken language, the question raises to what extent children with an implant will benefit from sign language. In this respect, a CI can be valuable for children: remarkable results have been reported with respect to speech and language outcomes, especially in children who received the implant at an early age (Niparko, et.al., 2010; Colletti, Mandalà, Zoccante, Shannon & Colletti, 2011). Recent studies show that many implanted children are in fact able to attend mainstream schools (De Raeve & Lichtert, 2011).

As a result, there is a debate between advocates of raising children with a CI bilingually and advocates of the oral method only. Advocates of the bilingual approach state that sign language does not negatively influence the acquisition of spoken language – an idea that has been supported by several studies (Connor, Hieber, Arts & Zwolan, 2000; Preisler, Tvingstedt & Ahlström, 2005; Percy-Smith, Cayé-Thomasen, Breinegaard & Hedegaard Jensen, 2010). Members of the deaf community themselves advocate a bilingual approach (Gale, 2011), which is not surprising, since the deaf community usually considers deafness to be a cultural phenomenon rather than a disability. In their opinion, the use of sign language is central to deaf culture. People in the deaf community fear that if sign language disappears, it might also bring the end of deaf culture. In contrast, advocates of the oral method only approach showed that a bilingual approach might limit the effectiveness of spoken language development in someone with a CI (Geers, Nicholas & Sedey, 2003; Miyamoto, Kirk, Svirsky & Sehgal, 1999; Wie, Falkenberg, Tvete & Tomblin, 2007).

Taken together, in the wider social context of children with a CI, there is no consensus on their mode of communication. As parents and other people in the child's immediate environment depend on the availability of the services provided there, this may affect the child's development. If, for example, parents decide that their child should learn spoken language only, but social services and schools use a bilingual approach, it will be very difficult for parents to maintain their preference for spoken language only. Although children with a CI in the Netherlands are usually raised and educated in a bilingual environment, the effect on their language development of the specific characteristics of the Dutch bilingual environment is unknown. Therefore, a study was conducted at the effect of linguistic environment on spoken language development, in which language development of Flemish children with a CI and Dutch children with a CI were compared. In the Netherlands, children with a CI are educated in a bilingual setting: schools offer bilingual programmes, with both sign language and spoken language. Contrarily, in the Dutch speaking part of Belgium (Flanders), most children with a CI are raised in a dominantly monolingual educational setting where spoken language is used, supported by signs and visual communication strategies.

Influence of CI on children's social-emotional development

One aspect of functioning that depends strongly on language and communication is children's social-emotional functioning (Hosie, Russell, Gray, Scott, Hunter & Banks, 2000; Bosacki & Moore, 2004; Barker, Quittner, Fink, Eisenberg, Tobey & Niparko, 2009). In deaf children without a CI, this seems to be impaired: they have more problems maintaining social contacts and friendships than hearing children do, and also report loneliness more (Keilmann, Limberger & Mann, 2007). Not only are these children less popular and less accepted in their peer group than their normally hearing peers (Wolters, Knoors, Cillesen & Verhoeven, 2011), they also have a higher risk for behavioral problems (Van Eldik, Treffers, Veerman & Verhulst, 2004; Stevenson, McCann, Watkin, Worsfold & Kennedy, 2010).

In normal-hearing children, social functioning is strongly related to emotional functioning (Denham, 2003). In fact, two aspects of emotional functioning are crucial for adaptive social functioning: the ability to regulate and communicate one's own emotions, and the ability to understand and anticipate others people's. The question is whether these aspects are equally important in the social functioning of deaf children.

In normally hearing children, a first requisite for adaptive social functioning is the ability to regulate their emotions and thus to express or communicate them in ways that do not harm their relationships with others, but strengthen them instead (Eisenberg, Fabes, Guthrie, & Reiser, 2000; Trentacosta & Shaw, 2009). The regulation and communication of emotion takes place within the context of social interactions and relationships, which they are intended to affect – by strengthening the bond with the other person, for example (in an expression of love), or by solving a conflict and restoring a former balance (in an expression of anger) (Frijda, 1986).

But in deaf children without a CI, the regulation and communication of emotion seem to be impaired: as Rieffe has shown (2006; 2011), their emotion regulation is less effective than hearing children's. For example, avoidant strategies are more effective than approaching strategies in situations that are beyond one's control, because distracting one's thoughts can diminish the negative impact of the situation, whereas focusing on the event might lead to worrying or rumination. However, eleven-year-old deaf children reported using more approaching and fewer avoidant strategies in negative uncontrollable situations than their hearing children peers (Rieffe, 2011). Not surprisingly, they also reported that the intensity of their negative emotions lasted longer.

Eleven-year-old deaf children were also less skilled in communicating their feelings adaptively in anger-evoking situations in which a peer inflicted harm on them (Rieffe & Meerum Terwogt, 2006). The study in question showed that deaf children explained their displeasure less than hearing children. As a result, they were also more pessimistic about receiving an empathic response from the aggressor than hearing children were. In other words, as well as having a less efficient style of emotion regulation in these kinds of scenarios than their hearing peers, many deaf children had a less effective communication style. As the study by Rieffe and Meerum Terwogt demonstrated (2006), this might cause peer conflicts to persist rather than be solved, or might harm deaf children's social contacts in other ways.

A second important aspect of emotional functioning that is directly related to children's social functioning is their ability to understand, predict or explain emotions in others. For instance, social competence and peer-rated popularity in children are strongly related to the ability to recognize the facial expression of emotions in other people, and to understand their causes (Denham, McKinley, Couchoud & Holt, 1990). Deaf children without a CI are known for their impairments in this respect. Most deaf children aged ten to twelve years are familiar with the four basic emotions: happiness, anger, sadness, and fear (Rieffe, 2011). They recognize these emotions, can predict them in others, and can attribute them to prototypical situations. However, these children do not understand more complex emotions, such as pride and jealousy. Moreover, they show little attention to emotions of others, often fail to understand them, and have difficulties recognizing the effect of emotion expressions on others (Hosie, et. al., 2000; Meerum Terwogt & Rieffe, 2004; Rieffe &, Meerum Terwogt, 2000; 2006).

These poor social-emotional skills in deaf children can be explained partly by poorer language skills (Barker, et. al., 2009; Wolters, et.al., 2011; Stevenson, et.al., 2010). Children with poor language skills have problems understanding the information in their social environment: this delays their emotional development, which leads in turn to problems in social functioning. When they are about two years old, normally hearing children start using emotion words to express their own feelings and to identify the emotions of others (Way, Yelsma, Van Meter & Black-Pond, 2007). Later, they start to talk about the reasons for emotional states, and also about their consequences. Problems in expressing emotions can lead to inadequate emotion regulation strategies and result in internalizing and externalizing behavior. The way children understand and express emotions influences their social relations with others and how they solve problems with others.

While language is crucial to children's social-emotional development, there is a second important factor: the immediate context in which children learn. For social-emotional development is possible only within a social context (Saarni, 1999). Early social-emotional development occurs within the family context, an important role being played by parents' ability to recognize, understand, and regulate their own emotions and those of others (Morris, Silk, Steinberg, Myers, & Robinson, 2007). According to Morris and colleagues (2007), emotion socialization involves three processes. The first mechanism through which this immediate environment influences emotional development is children's observation of their parents' emotional displays and interactions. Through this, children learn that certain situations provoke emotions; they also learn how they should react appropriately in similar situations. For example, if parents often display great pleasure when they receive a present, children learn that this is an appropriate reaction. Conversely, if parents often display disappointment when they receive a present, children are less likely to learn socially appropriate emotional reactions when they themselves receive one.

The second mechanism of emotion socialization is emotion-related parenting practices, i.e., parental behaviors that help a child understand his own and other people's emotions (Morris, et. al., 2007). Successful parental behavior consists of seeing opportunities to help children label their emotions, to discuss emotions with their child, and to help it react appropriately to emotions. Emotion-related parenting also involves parents' reactions to their children's negative and positive emotions. In general, negative reactions by parents to children's emotion are associated with poor emotion regulation.

Thirdly, emotional development is affected by the emotional climate in the family, which is reflected in relationship qualities. According to Morris et.al. (2007), a negative, coercive or unpredictable emotional climate puts children at risk for developing inappropriate emotion regulation skills, due either to frequent and unexpected emotional displays, or to emotional manipulation. In contrast, a responsive environment in which children feel emotionally secure and free to express their emotions enables children to develop appropriate emotion-regulation skills.

The social-emotional development of deaf children without a CI differs from that of hearing children because they have less exposure to and modeling by parents, and because of problems in interactions between parents and their deaf child (Rieffe & Meerum Terwogt, 2006; Hosie, Gray, Russell, Scott & Hunter, 1998). The parenting styles of parents of a deaf child also differ from those of parents with normally hearing children. For example, parents with a deaf child are more likely to use physical discipline in response to perceived child transgression (Knutson, Johnson, & Sullivan, 2004); this models the child with other social rules – probably ones that are less appropriate.

Finally, parental stress, which often occurs in parents of children with a CI (Hintermair, 2006), may result in less supportive (e.g. emotion-focused, expressive encouragement) and more non-supportive (such as those that express distress or are punitive) responses to teach their CI child about emotions (Nelson, O'Brien, Nayena Blankson, Calkins & Keane, 2009). As non-supportive parental responses to negative emotions show a child that the display of these emotions is not acceptable, this can in turn impair social-emotional development. In contrast, supportive parental responses to negative emotions have been found to be related to better emotion understanding and social competence (McElwain, Halberstadt & Volling, 2007).

To date, however, it is unclear to what extent children with a CI also have these social-emotional problems. Even if their language development is similar to that of normal hearing children, they may still have problems and impairments in their social-emotional development. Although such children have gained access to (more) sound, their level of hearing is still far from that of NH children; in most cases, their speech perception in a noisy environment is still poor (Kühn-Inacker, Shehata-Dieler, Müller, & Helms, 2004; Galvin, Mok, Dowell & Briggs, 2007). A study of peer relationships between children with a CI showed that five- to six-year-old children had no difficulty socializing with hearing peers in one-to-one situations, but socialized less easily when faced with an already established dyad (Martin, Bat-Chava, Lalwani, & Waltzman, 2011). However, there are also many instances or situations in which these children cannot or do not want to use their CI – such as at the swimming pool – and are thus isolated from their peers.

In conclusion, it is not clear how emotion understanding, emotion regulation and social functioning in children with a CI develop, and how this development is related to language development and interaction with parents and other people. To fill this gap, children with a CI were compared with normal hearing children on aspects of emotion understanding, emotion regulation and social functioning.

Outline of this thesis

As argued above, children's development is determined not only by their characteristics, but also by the environment in which they live and grow: their immediate and wider social contexts. A deaf child's environment differs from that of normal-hearing children. Although greater understanding has been gained over recent years of their language and social-emotional development, and of the influence on these of their environment, less is known about the development of deaf children with a CI and of how their development is influenced by their social contexts. This thesis aims to provide insight into some aspects of language and social-emotional development, and into the influence of certain factors in their social context that affect it.

In Chapter 2, the focus is on parents of children with a CI from Turkish origin and their family counselors. Their desires, expectations, experiences, and problems regarding rehabilitation and counselling were studied to provide insight into the quality of the interrelationship between the settings in which children with a CI participate. We also sought insight into how parents of Turkish origin are influenced by dominant cultural values in Dutch society, and how these values indirectly influence the development of these children.

In Chapter 3, the effects of the linguistic environment of infants (i.e. a monolingual setting versus a bilingual setting) on their language development is examined. The language development of Flemish children with a CI and Dutch children with a CI were compared. In the Netherlands, such children are raised in a bilingual educational setting: schools offer bilingual programs, with both sign language and spoken language. However, in Flanders – the Dutch-speaking part of Belgium – most children with a CI are raised in a dominantly monolingual educational setting where spoken language is used, supported by signs and visual communication strategies.

In chapter 4 we studied the relation between social functioning of young deaf children with a CI and emotion regulation. Social functioning involves the ways in which children initiate and maintain relationships with meaningful others around them; emotion regulation is an individual's ability to transform an emotion or to devise coping mechanisms to manage emotions. It is assumed that, in a normal population, proper emotion regulation is associated with good social functioning, such as high social competence and few behavioral problems (Eisenberg, Spinrad & Eggum, 2010).

Chapter 5 explores two aspects of the ability to understand emotions in young deaf children with a CI: emotion recognition in facial expressions, and emotion attribution in a situational context. This ability was assessed for the four basic emotions: happiness, anger, sadness and fear, as these are the first emotions with which children are familiar.

Discussing the results in within the perspective of Bronfenbrenner's social-ecological model, Chapter 6 presents practical implications, and also implications for future research.

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Chapter 2

Family Counseling in the Netherlands for Turkish-Origin Parents of Deaf Children With a Cochlear Implant

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Abstract

Cultural elements such as language, beliefs about health, and family context play important roles in the uptake of rehabilitation and treatment of deafness. Because of cultural issues, minority groups often do not receive optimal care. Focusing on the Netherlands, the researchers explored how the rehabilitation and counseling of deaf children of Turkish-origin parents can be improved. The most important findings were that (a) most parents initially did not believe their child was deaf and regretted later that they did not start hearing rehabilitation earlier; (b) parents had little confidence in the Dutch health care system and sought a second opinion from a medical doctor of their own national origin; (c) parents did not know how to be actively involved in the care of their deaf child. Implications for practice aimed at improving rehabilitation and counseling for these children are described.

Introduction

Since the implementation of neonatal hearing screening, deafness is usually diagnosed at the age of approximately 3 months. A diagnosis of deafness has a profound impact on parents: They may experience grief, anger, guilt, denial, confusion, and feelings of helplessness (Steinberg, Delgado, Bain, Li, & Ruperto, 2003). Although all parents are greatly affected by the deafness of their child, not all families respond in the same way. Cultural elements such as language, beliefs about health, and family context play important roles in the uptake of rehabilitation and treatment of deafness (Louw & Avenant, 2002; Steinberg et al., 2003). With the increase in immigration from countries all over the world, Western societies are becoming more culturally diverse; consequently, cultural elements are becoming more important in the provision of health care in these societies.

In the Netherlands, immigrants from non-Western countries account for 11.6% of the total population (Statistics Netherlands, 2009). Most of these immigrants are from Turkey, Morocco, Surinam, and the Netherlands Antilles, and therefore constitute a heterogeneous community. Although some of these groups share the same language and some the same religion, they also differ in several characteristics. The largest group is of Turkish descent (2.4%), followed by immigrants of Moroccan descent (2.2%).

Family counselors at our organization, the Dutch Foundation for the Deaf and Hard of Hearing Child, noticed problems in the rehabilitation and counseling of deaf children of Turkish and Moroccan descent without understanding why these problems were occurring. In response, a group of us conducted a study (Wiefferink, Vermeij, Stege, Van der Spaai, & Uilenburg, 2008) in which we compared seven deaf children of Dutch origin with seven deaf children of Turkish origin. All of the children had received a cochlear implant (CI). The study showed that, on average, children of Turkish origin received their cochlear implant (CI) 10 months later than children of Dutch origin (i.e., at age 33 months, as opposed to the Dutch children's age of implantation of 23 months). Furthermore, the results indicated that Dutch children with a CI had better language development 2 years after implantation: Not only was their spoken Dutch better than the spoken Dutch of Turkish children; also, their sign language was better. The researchers speculated that this poor language development by the Turkish children may have been partly caused by these children’s late implantation.

Studies on the effects of CIs on children show a stronger effect on language development when implantation occurs at a young age, particularly before the age of 2 years (I. Anderson et al., 2004; Miyamoto, Kirk, Svirsky, & Sehgal, 1999; Schauwers et al., 2004; Spencer, 2004; Svirsky, Teoh, & Neuburger, 2004; Tomblin, Barker, Spencer, Zhang, & Gantz, 2005; Wiefferink, Spaai, Uilenburg, Vermeij, & De Raeve, 2008; Zwolan et al., 2004). Studies conducted outside the Netherlands found similar results concerning the rehabilitation and treatment of deaf children from minority groups. In a study by Steinberg and colleagues (2003), parents from minority groups in the United States had difficulty making decisions about the care of their deaf child. This could be explained by difficulties communicating with professionals and by cultural differences, but also by insufficient access to information. Also, there are indications that some minority groups have less accessibility to health care. A study in the United States showed that White and Asian children received a CI more often than Hispanic and Black children (Stern, Yueh, Lewis, Norton, & Sie, 2005).

The delay in receipt of a CI by deaf children from nonmajority ethnic groups might be explained by cultural and language differences between health care professionals and parents. In general, health care systems are tailored to the needs of a country’s native-born residents, particularly those whose families have been in the country for at least several generations. Parents of children of non-Western origin might have different expectations from the health care system. In the Netherlands, for instance, parents of Turkish and Moroccan origin with children who have mental disabilities do not expect counseling from professionals, but material and practical support (Eldering, Adriani, Hamel, & Vedder, 1999).

Only a few studies have been conducted on how parents of deaf children of Turkish and Moroccan origin experience health care in the Netherlands. Yumusak and Hoogsteder (1999) found that parents of Turkish and Moroccan origin with deaf children had limited knowledge about how health care for deaf children is organized in the Netherlands. Even after regularly visiting an audiological center for years, these parents barely understood what services an audiological center provides. Consequently, their children's quality of care might not have been optimal. Moreover, the level of involvement of parents of Turkish or Moroccan origin in the rehabilitation of their deaf child is assumed to be lower than the level of involvement of parents of Dutch origin (Hannink, 2007). However, Nortier, Hoenderkamp, and Knoors (1996) found that although parents of non-Dutch origin felt highly involved with their deaf child, they did not know how to be actively involved in the rehabilitation and education of their child. Moreover, they often did not understand the information they received from health care professionals or teachers, either because their Dutch language was not sufficient or because their knowledge of the Dutch health care system was not sufficient.

Because the study by Wiefferink, Vermeij, and colleagues (2008) showed that the development of deaf children of Turkish origin is delayed compared to that of native deaf children, and because little is known about the reasons for this, we (the authors of the present article) decided to conduct an exploratory study in order to comprehend the nature of this problem better. The aim of the study was twofold. First, we wanted to explore how the rehabilitation and counseling of deaf children with a CI who are from immigrant groups can be tailored to these children's needs so that they might receive optimal care. Parents' and family counselors' desires, expectations, experiences, and problems regarding rehabilitation and counseling were studied, with a focus on differences between these two groups of participants. Differences between parents and family counselors are interesting because they provide clues on how to improve care. Second, we wanted to gain insight into the involvement of the parents in the rehabilitation of their child because this is an important predictor of how successful the CI is for the child (Moeller, 2000). We focused on deaf children of Turkish origin because we wanted to limit the diversity in the research group and because most deaf children of non-Western origin in the Netherlands are of Turkish origin.

Method

Study Design and Sampling

In the present study, which was an exploratory study, the Q-methodology (Stephenson, 1935; see discussed below under the heading “Q-methodology”) was used to collect data from parents and family counselors). We employed a purposive sampling technique in recruiting participants. Family counselors of Turkish deaf children in all rehabilitation services for the deaf in the Netherlands were approached to participate in the study. The family counselors asked parents of Turkish deaf children who had been selected to receive a CI to participate in the study. All family counselors who had a Turkish deaf child in their care agreed to participate. However, it was difficult to recruit families for this study for various reasons. For example, some parents did not participate because the interviews were time consuming; other parents had decided against a CI because of concerns about the surgery, and therefore could not take part. Given the number of participants and the design of our study, our sample may not be representative of parents of Turkish deaf children in the Netherlands.

Study Population

Eleven Turkish parents and their family counselors (all of who were of Dutch origin) were included in the present study. At the time of the study, there are no family counselors of Turkish origin or Turkish-speaking family counselors in the Netherlands in the field of counseling for families with a deaf child. The families lived across the whole of the Netherlands, in urban as well as rural areas. At least one parent from each couple had been born in Turkey, and all of the couples had a profoundly deaf child with a CI (i.e., a child with a hearing loss greater than 90 dB prior to implantation). The children (eight boys, three girls) had received their CI between the ages of 21 and 42 months. All of the parents had normal hearing except for two fathers: One father had a moderate hearing loss, and the other father was profoundly deaf.

In nine families, the parents communicated with their deaf child mainly in spoken Turkish. In four of these families, the mother used spoken Turkish supported with signs. One family communicated only in Dutch, whereas the family with the profoundly deaf father mainly used sign language. In each family, one of the parents had been educated in Turkey, whereas the other parent had been raised—and educated—in the Netherlands. All of the parents had a low educational level, varying from primary school to lower vocational training. In two families, both parents were unemployed, in eight families the fathers had a blue-collar job and the mothers took care of the children, and in one family both parents worked. Formal evaluation with the Snijders-Oomen Nonverbal Intelligence Test (Tellegen, Winkel, Wijnberg-Williams, & Laros, 1998) showed that nine children had normal cognitive and motor development, one child had delayed cognitive and motor development, and one child had Recklinghausen syndrome (a condition whose characteristics often include scoliosis, learning difficulties, eye problems, and epilepsy).

Q-methodology

Q-methodology, developed by Stephenson (1935) and further advanced by Brown (1996) and McKeown and Thomas (1988), is a means of extracting subjective opinions in a research situation.

The first step in Q-methodology is to describe all possible topics that cover the situation that is being explored. In the present study, an inventory was made of all aspects of care delivered to parents of deaf children (76 aspects in all; see Appendix). The topics concerned (a) medical aspects, such as the importance of a CI and a second opinion; (b) counseling aspects, such as speech therapy, advice about communication with a deaf child, grief counseling, and support with raising deaf children; (c) the provision of information, such as written information, oral information, and flyers; and (d) logistical aspects, such as arranging for child care and addressing transportation and financial issues.

In the second step, parents as well as family counselors were asked how important, in their opinion, a topic was in the care of deaf children. Each of the 76 topics was written on a card. In interviews, parents and family counselors were asked to sort the cards according to their level of importance: very important, important, or not important. They were also asked to provide reasons why they had assigned a particular level of importance to a topic. Blank cards were also provided in order to give parents and family counselors the opportunity to add relevant topics that were not on the list. However, none of the participants made use of this opportunity. Parents were also asked about their expectations and desires concerning the rehabilitation and counseling of their deaf child.

In addition to participating in the Q-methodology process, parents took part in interviews 2 years after implantation. They were asked to reflect on their experiences with rehabilitation and counseling and on problems they had encountered. A semistructured interview with open questions such as “Looking back on the care and counseling you received, what did you miss?” and “What problems did you encounter concerning the care and counseling you received?” was used.

Analysis

Although the present study was qualitative, a cutoff score was needed in order to classify topics as very important or not important. The reason we did not include the category “important” was that we were merely interested in what parents and family counselors found most important, because parents as well as family counselors tended to rate most topics as important. If the majority agreed about the extent to which a topic was very important, it was considered to be the opinion of at least a relevant part of the population. Therefore, a topic was classified as very important if more than half of the parents labeled it as very important and was classified as not important if more than half of the parents labeled it as not important. The same was done with the family counselors.

Results

Expectations and Desires Concerning Rehabilitation and Counseling

Parents rated more topics not important or very important than family counselors did (Figure 1). Topics labeled by more than half of the parents and by more than half of the family counselors as very important included, among others, being taken seriously by physicians and other health care professionals, availability of counselors for questions by telephone, receiving an overview from the family counselor of everything that happened with the child, sign language courses, and support with making decisions about the child. Topics labeled by more than half of the parents and by more than half of the family counselors as not important were communicating with parents with a deaf or hard of hearing child through the Internet and a yearly overview of the schedule of all parental courses.

Topics That Parents Found More Important Than Family Counselors Did

Some topics were very important to parents, whereas family counselors rated them as not important.

First, in contrast with family counselors, Turkish parents in the present study had a high interest in a second opinion from a Turkish physician. Parents of seven children actually visited a Turkish physician for a second opinion, either in Turkey, the Netherlands, or Germany. Two other parents very much wanted a second opinion from a Turkish physician, but were not able to arrange this. One parent explicitly told the interviewer that she did not have any confidence in the Dutch health care system, and seven other parents expressed that they were only able to accept the fact that their child was deaf after a Turkish physician confirmed the diagnosis. Only one parent told the interviewer that she trusted the Dutch physicians. This parent declared that the Dutch physicians explained everything very well, but that she was not mentally ready to accept that her child was deaf.

Second, parents had a need to address practical issues, such as the availability of playthings for deaf children, counseling on how to read books to their child, and the availability of a babysitter. In general, family counselors classified these topics as not important. Finally, 8 of 11 parents expressed that a CI was very important to them, whereas only two family counselors agreed with this.

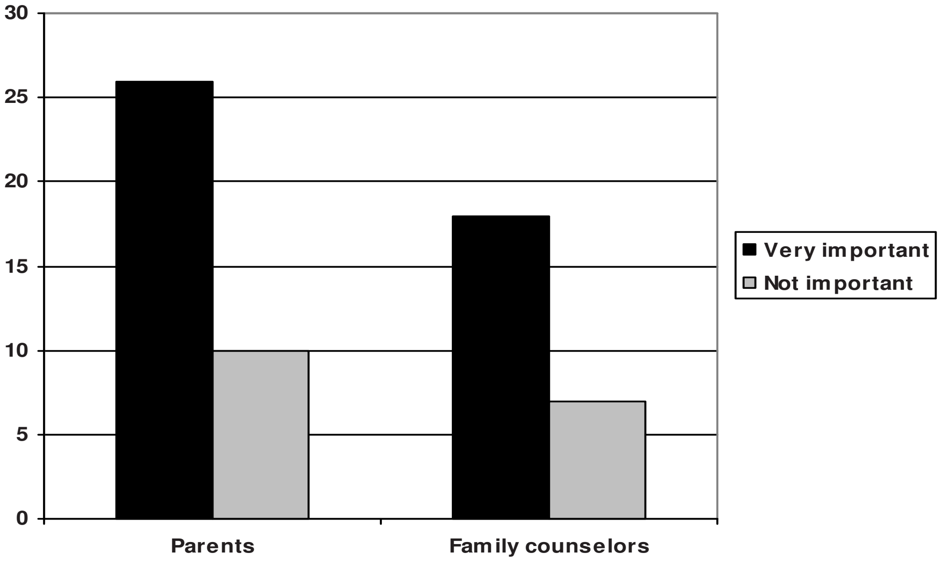

Figure 1 Number of Aspect-of-Care Topics Rated Very Important and Not Important by Parents and Family Counselors

Parental Involvement

Most family counselors expressed the view that, in general, Turkish parents were less involved in the care of their deaf child than parents of Dutch origin. This does not mean that Turkish parents had no involvement at all with their child. As one of the family counselors put it, Turkish parents were highly involved with their children, but minimally involved in the professional care their child received. Another family counselor stressed that although some families tried very hard, they often did not know what they could do, probably because of language problems and cultural differences. For instance, Turkish parents did not stimulate their children to communicate as much as Dutch parents did; specifically, they did not stimulate the hearing and language development of their child.

Some parents did not realize that the family counselor could teach them how to communicate with their child. In one family, the mother thought that the family counselor's role was to do exercises with the child, but she did not realize that the goal of the exercises was to teach the mother how to communicate with her child. In this family, the mother was also not aware that she had to do these exercises with her child. In this example, it is possible that the mother did not know what was expected of her due to language problems. But it is also possible that this misunderstanding was caused by cultural differences, because the mother was accustomed to a culture in which health care professionals take over the whole rehabilitation process from parents, whereas Dutch family counselors are trained to teach parents how to communicate with their child.

Another reason for relatively low involvement in the professional care of their child might be that Turkish parents had difficulties accepting the deafness of their child. Parents and family counselors both expressed that Turkish parents have problems accepting that their child is deaf. Most parents said that they did not believe it at first. They hoped that the deafness would disappear over time, much like an illness that could be cured. Some parents also felt ashamed that their child had a disability, and consequently did not inform their relatives immediately, especially not their relatives in Turkey. The fact that Turkish parents had difficulty accepting their child's deafness caused a delay in the cochlear implantation in some instances. Two years after their child received an implant, a few parents remarked that they regretted not having had it done earlier. They realized that children who received a CI at a younger age had better language development.

Discussion

The results of the present study show that Turkish parents and family counselors have different views on some aspects of the care of deaf children with a CI. Our findings are in line with those of other studies regarding the influence of cultural elements in health care. For example, the fact that most parents did not believe that their child was permanently deaf and that they thought of deafness as an illness that could be cured is consistent with the findings of a study by Eldering and colleagues (1999). Also, the fact that parents and family counselors had different perspectives on how to communicate about decisions concerning rehabilitation and counseling is in line with the findings of other studies (De Graaff & Eitjes, 2004; Steinberg et al., 2003). Non-Western immigrant parents want to hear what the best solution to their problem is: "Most people from ethnic minorities do not want a good conversation but good care. They expect that the health care professional will help them and not only talk to them" (De Graaff & Eitjes, 2004, p. 23, translated from the Dutch).

Limitations of the Study

The present study was designed as an exploratory qualitative study. Given the sample size and design, the results cannot be generalized to non-Western immigrant parents or even to parents of Turkish origin. Despite this, some patterns were revealed regarding problems with the Dutch health care system experienced by Turkish parents with deaf children. Moreover, other studies show that other non-Western immigrant groups experience problems similar to those of the immigrants from Turkish origin in our study (De Graaf & Eitjes, 2004; Eldering et al., 1999; Steinberg et al., 2003). Because of the large numbers and diversity of the Turkish people and other immigrant groups, a larger study would be necessary, in which parents of other minority groups were included, to enable a fuller understanding of the influence of cultural elements in health care for deaf children.

Implications for Practice

The present study provides some clues for improving rehabilitation and counseling for deaf children of Turkish origin with a CI.

A striking finding of the study was that some parents regretted that their child did not receive a CI at a younger age. They saw that children who had received a CI at a younger age had better language development than their own child. To support parents with decisions concerning hearing rehabilitation, health care professionals could focus on the regret that parents have by anticipating this regret. In health education and health promotion, this tactic, called *anticipated regret*, is often used. Anticipated regret refers to feelings of regret that people anticipate they will experience if they refrain from a certain behavior. It is assumed that decision makers anticipate the experience of negative emotions, and take them into account when making decisions (Zeelenberg, Van Dijk, Manstead, & Van der Pligt, 2000). If people expect to experience feelings of regret when refraining from a certain behavior, this might influence their decision. This might also be the case for parents with a deaf child. The importance of anticipated regret as a predictor of behavior has been shown in several studies (C. J. Anderson, 2003; T. Connolly & Reb, 2005; Humphrey, 2004; Kellar & Abraham, 2005; Nordgren, Van der Pligt, & Van Harreveld, 2007; Zeelenberg, 1999). If parents are aware at an early stage of the fact that a delay in commencing hearing rehabilitation can cause feelings of regret, this might convince them to start rehabilitation as soon as possible, including cochlear implantation.

One way to anticipate the regret of parents and the accompanying negative emotions might be to ask other parents from the same ethnic group to tell their own story about how they experienced the first years of their deaf child's life, how they made their decisions, and how they felt afterward. Also, referring parents to a physician of the same ethnic group for a second opinion at an early stage might prevent a delay in cochlear implantation. This physician would be able to take the same cultural perspective as the parents. This could help convince the parents that their child was deaf and that it was important to start hearing rehabilitation as soon as possible.

Communication between the parents and health care professionals was not always optimal, often partly due to differences in preferred language. In the opinion of family counselors, access to the services of a speech interpreter is very important, whereas parents think it is less important. There might be several reasons why the parents in our study did not think an interpreter was needed. First, they might have become convinced that they had mastered the Dutch language. Second, they might have asked a relative to act as an interpreter. Finally, they might have feared that their private life would become public in their own community. If parents do not master the Dutch language fully, family counselors might want to persuade them to ask for an interpreter. In this case, it is important to explain that professional interpreters are free of charge and that they maintain strict confidentiality. Even if the parents do master the Dutch language fully and it is not necessary to use an interpreter, it is important that family counselors check on a regular basis how the parents interpret the counseling information they receive. Moreover, it is important that family counselors summarize parents' responses in order to check whether they understand the parents.

Cultural differences are probably responsible for the fact that family counselors and parents seem to have opposite perspectives when it comes to how to make decisions about rehabilitation and counseling. Parents prefer physicians and other health care professionals to make the decisions and tell them what is best for their child. By contrast, health care professionals in the Netherlands usually provide parents with objective information, including the advantages and disadvantages of different options, so that parents can make their own decision. The parents in our study did not seem to appreciate this: After all, the health care professional is the expert! The fact that the Dutch health care system does not work this way might explain why Turkish parents have little confidence in the Dutch health care system. Consequently, these parents seek the opinion of a health care professional they do trust.

In our study, most parents went to a Turkish doctor for a second opinion. Only when this doctor confirmed that their child was deaf were they ready to decide in favor of a CI. However, the problem is that they usually consulted a Turkish doctor while they were on holiday in Turkey. This meant that valuable time passed without optimal hearing rehabilitation, and this might inhibit or delay the child's language development. Health care professionals should be aware of this situation and try to convince parents that starting rehabilitation early is very important for the language development of their child. One way to do this is to refer parents for a second opinion to a physician specializing in ear, nose, and throat who is of their own ethnic group and who resides in the Netherlands.

Another important finding was that parents did not know how to be actively involved in the care of their deaf child. Ethnic minorities in Western societies are usually more collectivistic than native inhabitants (Kagitcibasi, 2005). According to Kagitcibasi (2005), heteronymous morality is the norm in a collectivistic culture. This means that the individual is subject to another's rule; that is, the individual is governed from outside. In contrast, in more individualistic cultures an autonomous morality is the norm; that is, the individual is subject to his or her own rule.

In general, relatives are usually more important for non-Western immigrant parents, including parents of Turkish origin, than for Dutch parents (Kagitcibasi, 2005). Relatives can influence parents: They can be supportive, but also a source of stress. Either way, it is important to involve relatives in the child's care. An intervention that empowers parents and at the same time involves relatives is the Family Group Conference (FGC) model, an intervention developed in New Zealand. The FGC model aims to turn the traditional decision-making process on its head: Rather than a meeting of family members that is dominated by the presence and agenda of professionals, the FGC is predominantly a meeting of the family group (M. Connolly, 2006; Lupton, 1998). Professionals attend in the capacity of information givers, rather than as the involved professionals. The family uses the information gathered at the conference to formulate a plan. Responsibility rests with the family, and professionals should allow the family to carry out the plan, however unconventional, unless the plan causes harm to the child. Currently, we are implementing the FCG model at the Dutch Foundation for the Deaf and Hard of Hearing Child.

In conclusion, the present study shows that Turkish parents and family counselors have different views on the care of deaf children with a CI. Care in the Netherlands is insufficiently tailored to the needs of Turkish parents. It is plausible that this is also true for other immigrant groups, not only in the Netherlands but also in other countries with several minority groups. With the global growth of immigration, it is important to tailor care to the needs of these immigrants. In this way, hearing rehabilitation will be more beneficial for deaf children from minority groups.

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Appendix

Interview Topics

1	Information about schools.
2	A second opinion from a Turkish physician.
3	Counseling with a physician or audiologist.
4	Cochlear implant (CI).
5	Clear report about the development of my child.
6	Explanation about CI and the surgery.
7	Taken seriously by physicians and other health care professionals.
8	Explanation of the results of diagnostic tests.
9	Information about hearing loss during regular visits of family counselor.
10	Counseling about the future of my child.
11	Support with making decisions about my child.
12	Playthings suitable for my child.
13	Immediate counseling after learning that my child has hearing loss.
14	A hearing aid as soon as possible.
15	Counseling on how to communicate with my child.
16	Receiving an overview from the family counselor of everything that happened with my child.
17	Learning how to develop a good connection with my child.
18	Counseling on how to read books to my child.
19	The child should be seen as a normal child and not as a problem.
20	Availability of counselors for questions by telephone.
21	Explanation about medical and audiological aspects.
22	Sign language courses.
23	Written information about hearing aids and how to use them.
24	Written information about CI and the surgery.
25	Physicians and other health care professionals inform each other and are familiar with the care others provide.
26	Explanation about the cause of the hearing loss.
27	Support with organizing devices and other aids.
28	Detection of hearing loss by means of diagnostic tests.
29	Explanation about the functioning of hearing aids.
30	Explanation about the consequences of hearing loss in daily life.
31	Information about several types of hearing tests.
32	Counseling on what can be expected in the coming year.

33	Speech therapy at home.
34	Consultation on the use of sign language.
35	Consultation on the use of spoken language and speechreading.
36	Written information on how to communicate with my child.
37	Answers to practical questions such as whether my child can cycle on a public road.
38	Support with financial aspects.
39	A reliable babysitter.
40	Support from a social worker.
41	Counseling on problems and distress.
42	Support with child-raising issues.
43	Time to learn how to deal with the hearing loss.
44	Relatives and friends learn how to communicate with my child.
45	Learn how to enjoy my child.
46	Courses on how to deal with my deaf child.
47	Support with teaching my child spoken language.
48	Visiting the audiological center.
49	Support with the daily use of hearing aids.
50	I decide what is going to happen with my child.
51	Information and counseling for teachers at my child’s nursery school.
52	Learn how to pay attention to the other children in our family.
53	As few health care professionals visiting our home as possible.
54	Written information on deafness and hearing loss.
55	Information on devices at home.
56	Written information on what to expect in the near future.
57	Transport to the audiological center.
58	To be left alone as much as possible.
59	Support in case of stress between me and my partner concerning the care of our child.
60	Courses on how babies communicate by means of babbling, smiling, crying, watching, etc.
61	Courses in sign language for the whole family.
62	Attending a special baby or toddler nursery school.
63	Meet other deaf or hard of hearing children and adults.
64	A deaf adult who is doing well should be held up as an example.
65	Support with teaching my child the Turkish language.

66	Information on deafness for relatives and friends.
67	A deaf child who is doing well should be held up as an example.
68	Meet other Turkish parents with a deaf or hard of hearing child.
69	The presence of a Turkish interpreter during family counselor visits.
70	Course on how young children learn to speak.
71	Family counselor of Turkish origin.
72	Information about parent organizations.
73	Family counselors communicate with my relatives.
74	Communicate with parents with a deaf or hard of hearing child through the Internet.
75	Meet other parents with a deaf or hard of hearing child.
76	Yearly overview of the schedule of all parental courses.

Chapter 3

Influence of Linguistic Environment on Children's Language Development: Flemish versus Dutch Children

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Abstract

In the present study, language development of Dutch children with a cochlear implant (CI) in a bilingual educational setting and Flemish children with a CI in a dominantly monolingual educational setting is compared. In addition, we compared the development of spoken language with the development of sign language in Dutch children. Eighteen children with a CI participated in the study: six Dutch children older than 18 months at implantation and 12 Flemish children, of whom seven were younger than 18 months at implantation and five were older than 18 months. Tests were administered on auditory perception, speech intelligibility, spoken language and sign language (Dutch children). Five assessments were made to monitor language development of the children: a pre-test before implantation and four post-tests at six, 12, 24 and 36 months after implantation. In general, Flemish children showed more progress in spoken language development than Dutch children. Moreover, earlier implanted Flemish children showed more progress than later implanted Flemish children. This applies to auditory perception, speech intelligibility and spoken language. Whereas spoken language of Dutch children improved in the course of time, the development of sign language in Dutch children did not show any progress. Despite possible alternative explanations, such as better residual aided hearing before implantation or more professional support, it is plausible that the differences are partly caused by the linguistic environment. The lack of progress in development of sign language might be explained by the decreasing use of sign language by parents after implantation.

Introduction

A cochlear implant (CI) increases deaf children's access to sound substantially and it is one of the most important technological breakthroughs for deaf people. Studies on the effects of CIs in children show a positive influence on speech recognition, speech intelligibility and other aspects of spoken language development (Schauwers et al., 2004b; Svirsky et al., 2000, 2002b; Thoutenhoofd et al., 2005; Vermeulen et al., 2007). These effects are even stronger in children younger at implantation. Several studies show that spoken language development of these younger children is within the normal range, although often at the lower end (Anderson et al., 2004; Miyamoto et al., 1999; Schauwers et al., 2004a; Spencer, 2004; Svirsky et al., 2004; Tomblin et al., 2005; Zwolan et al., 2004). Further, children who receive their CI before the age of one develop preverbal communication skills to an extent that does not differ a lot from normally hearing children (Tait et al., 2007).

In the Netherlands, the intention is to raise children with a CI in a bilingual environment (i.e. spoken Dutch and Sign Language of the Netherlands (SLN)). However, the question arises whether deaf children with a CI should still be educated bilingually. After all, their spoken language seems to be adequate for participating in a hearing environment. Moreover, most studies on monolingual versus bilingual settings seem to indicate that children with a CI in dominantly monolingual settings have better spoken language development than children in bilingual or total communication settings (Geers et al., 2003; Kirk et al., 2002; Miyamoto et al., 1999; Vieu et al., 1998; Wie et al., 2007). Geers et al. (2003) found that children with a CI educated in monolingual settings exhibited a significant advantage in their use of narratives, the breadth of their vocabulary, in their use of bound morphemes, in the length of utterances and in the complexity of syntax used in their spontaneous language. Miyamoto et al. (1999) reported that children educated through oral communication had significantly better speech perception than did those educated through total communication. Wie et al. (2007) examined 79 of the first 100 children with a CI in Norway and concluded that children educated in mainstream schools, and thus merely used spoken language, had better speech recognition. Kirk et al. (2002) found similar results: spoken word recognition improved at a faster rate in monolingual children and they also demonstrated more rapid gains in communication abilities than in children who used total communication. Also, Vieu et al. (1998) found that the educational mode of communication appears to influence speech production and language quality. The language level as indicated by correctly organised sentences was higher in both spoken and cued-speech group than in the sign language group.

In contrast with these studies, other studies report no differences between language outcomes of children with CIs enrolled in oral communication or total communication settings. Connor et al. (2000) found no differences between children with a CI, implanted before the age of five years, in an oral communication setting and a total communication setting on consonant production accuracy, whereas children in a total communication setting achieved significantly higher receptive spoken vocabulary scores. Further, Nordqvist and Nelfelt (2004) and Yoshinaga-Itano (2006) found that language development of children with a CI who acquired sign language before implantation was age-appropriate.

There are some difficulties with interpreting the results of studies comparing different educational settings. First, the non-monolingual settings in these studies differ from each other, varying from equal input of sign language and spoken language to total communication (using some form of sign language in addition to spoken language, usually simultaneously) to cued speech (a soundbased visual communication system which uses hand shapes in different locations (cues) in combination with the natural mouth movements of speech to make all the sounds of spoken language look different). Second, a limitation of most of these studies is the small number of participants. Third, it is not possible to compare the results of the studies, because different tests were used.

However, choosing a linguistic environment for children with a CI probably is not only determined by the effectiveness of the linguistic environment on spoken language development. Other factors might also be important. A factor in favour of a monolingual environment might be children’s and their parents’ preference for a communication mode. There are indications that most children with a CI for several years prefer spoken language instead of sign language in communication with their hearing environment. In a study on the opinion of deaf young people with CIs, all the young people requested either spoken language or spoken language supported with signs, while sign language interpretation was available (Wheeler et al., 2007). Spoken language was the preferred mode of communication for 69 per cent, the other 31 per cent preferred sign supported English. Also, parents tend to rely more and more on spoken language the longer their child wears the CI (Archbold et al., 2000; Nordqvist and Nelfelt, 2004; Preisler et al., 2005). Preisler et al. (2005) found that when children started to wear a CI parents asserted the importance of using sign language, saying that this was the basis for communication. After the children started using speech, sign language was only used occasionally: most of the communication in the family was in spoken language. But there are also factors in favour of choosing a bilingual environment. For instance, one factor might be the uncertainty whether children with a CI will be able to adapt themselves fully to spoken language. When wearing the CI, their access to sound might be increased, but they are still not normal hearing. Usually, they encounter the same problems as children who are hard of hearing, such as problems with hearing in noisy environments or understanding spoken language in group communication. In these situations sign language or sign supported spoken language might also be of benefit to children with a CI. Another factor might be that children do not always wear their CI. In a study on the experience of 11 children aged between 8.6 and 10.6 with a CI during 5.0 to 7.6 years, most children considered the implant as a natural part of their life and used their implants daily, but they took it off for special occasions such as sport activities (Preisler et al., 2005). Further, these children thought that in order to reach full understanding when the topic was abstract, complicated, or important, sign language was necessary. A third factor in favour of choosing a bilingual environment might be that it enables children with a CI to be part of the Deaf community.

For deaf children who do not have a CI, there are indications that a bilingual environment has advantages. When comparing Swedish children raised with spoken language (in the 1960s) and children raised with both spoken and sign language (20 years later) the latter had a higher level of academic achievement, particularly in the understanding and use of written Swedish, but also in numerical and mathematical tests (Heiling, 1998). The children raised with both spoken and sign language also had more ‘normal’ family relations, as parents and children had been able to communicate with each other (Heiling, 1994). Preisler and Ahlström (1997) found similar results when they concluded that sign language had positive effects on language development. The improved language skills allowed deaf children to take part in dialogues and to share experiences with others, but also had a positive effect on social and emotional development.

To conclude, whereas a bilingual environment seemed a good option for deaf children without a CI, there is inconclusive evidence from literature whether children with a CI should be raised in a bilingual or monolingual environment. The literature shows that a monolingual environment might be better for spoken language development, whereas a bilingual environment might be better for communication and social and emotional development. This lack of clarity often leads parents to wonder whether they should use sign language when their child has received a CI. The answer of Delore et al. (1999) to this question is ‘that as long as we cannot be certain that, thanks to CI, the deaf child will be able to adapt himself fully to oral language we have no right not to propose sign language’ (p. 209).

In the present study, language development of Flemish children with a CI and Dutch children with a CI is compared. In the Netherlands, children with a CI are educated in a bilingual setting: schools offer bilingual programmes, with both SLN and spoken language. Moreover, parents are encouraged to use gestures and signs with their deaf child, to attend sign language courses and to use all possible means of communication in order to establish well-functioning communication with their child. Contrarily, in the Dutch speaking part of Belgium (Flanders), most children with a CI are raised in a dominantly monolingual educational setting where spoken language is used, supported by signs and visual communication strategies. Differences and similarities in language development between Flemish children and Dutch children were assessed. Further, we compared the development of spoken language with the development of sign language in Dutch children. Finally, we also compared children who received their CI around their first birthday and children who received their CI around their second birthday.

Method

Design

There were two conditions in this longitudinal study: Dutch children in a bilingual educational setting and Flemish children in a dominantly monolingual educational setting. The most important difference between the two conditions was that in the Netherlands both spoken Dutch and SLN were used in educational settings, whereas in Flanders spoken Dutch, supported by signs and visual communication strategies, was used in educational settings. Another difference is that parents of the Dutch children were educated in SLN: on average, they attended three courses (in total 30 lessons). Parents of Flemish children were not taught sign language, although parents of five Flemish children attended a course on Simultaneous Communication. As a result of the decreasing age at implantation in Flanders, there was great variability in the age of implantation in this group (Table 1). Therefore, the Flemish children were divided into two groups: children who received their CI before the age of 18 months (earlier implanted Flemish children) and children who received their CI after the age of 18 months (later implanted Flemish children). Five assessments were made to monitor the development of the children: a pre-test before implantation and four post-tests at six, 12, 24 and 36 months after implantation.

Participants

Eighteen children with a CI were selected: six Dutch children and 12 Flemish children (Table 1). Four out of six Dutch and 11 out of 12 Flemish children received a Nucleus device, two Dutch children an Advanced Bionics implant and one Flemish child a Digisonic implant. All children were deaf from birth, the implants were fully inserted and there were no complications during surgery. They all had a non-verbal intelligence within the normal range and none of them had any other serious impairments. All children were from Dutch or Flemish origin and the native spoken language at home was Dutch. The Flemish children had significant better residual aided hearing than the Dutch children (Mann-Whitney, U (N = 18) = 14, p = 0.04). Two Dutch children and one Flemish child had problems wearing the device for a short period of time. The first year after implantation, parents of the Dutch children communicated in both sign language

Table 1. Characteristics of children

	Gender Male (M)/ Female(F)	Average residual aided hearing at 500, 1000, 2000 en 4000 Hz in dB	Age at start family support	Age at onset wearing hearing aid(months)	Age at implant (months)	Non-verbal IQ
Bilingual						
Max	M	74	11	12	25	92
Tim	M	91	13	24	25	108
Thomas	M	115	14	16	23	104
Sanne	F	95	14	15	20	101
Lars	M	96	28	19	27	98
Fleur	F	100	14	15	24	86
Monolingual, > 18						
Bram						
Iris	M	81	5	6	22	91
Luuk	F	76	3	5	33	108
Anouk	M	68	3	4	22	91
Bart	F	80	3	3	20	110
	M	63	2	3	19	105
Monolingual, < 18						
Job						
Lotte						
Rick	M	74	6	6	15	98
Niels	F	98	9	9	13	95
Nick	M	58	3	4	8	110
Thijs	M	49	3	3	12	95
Jesse	M	80	3	3	9	110
	M	100	3	3	9	90
	M	90	3	4	15	110

and spoken language with their child, whereas parents of the Flemish children used spoken language, in five cases supported with signs. After one year, parents of the Dutch children started using more spoken language and less sign language, comparable with parents of the Flemish children. Family involvement of 15 of the 18 children was average to good (Moeller, 2000). Parents of three Flemish children were involved below average. The first year after implantation, all Dutch children in this study went to preschools where both spoken and sign language were used (half/half). After one year, five children went to a school where spoken Dutch was the instruction language and SLN was taught as a subject. One child went to a school were SLN was the instruction language and spoken Dutch a subject.

Testing materials

The children in this longitudinal study were administered tests on auditory perception, speech intelligibility, spoken language and sign language (Dutch children) to assess their language development.

Auditory perception

Auditory perception was assessed using the Categories of Auditory Performance (CAP) and the Meaningful Auditory Integration Scale (MAIS). The CAP is a rating scale of eight performance categories arranged in order of increasing difficulty and was administered by the speech therapist (Archbold et al., 1995). The MAIS was completed by parents and was developed as a face valid measure of speech understanding in everyday situations. It provides information about response to sound in everyday listening situations (Robbins et al., 1991b).

Speech intelligibility

The intelligibility of children’s speech was evaluated using the Speech Intelligibility Rating Scale (SIR) and the Meaningful Use of Speech Scale (MUSS). The SIR was administered by the speech therapist and was designed to classify children’s global speech production according to one of six hierarchical categories (McDaniel and Cox, 1992; Wilkinson and Brinton, 2003). The MUSS was completed by parents and was designed to assess the child's use of speech in different natural contexts (Robbins and Osberger, 1991a).

Spoken language

To assess spoken language development, the Dutch version of the receptive language part of the Reynell Developmental Language Scale and the Schlichting Scale for language production were used at 24 and 36 months after implantation (Lutje Spelberg et al., 2001; Van Eldik, 1998). The Reynell and Schlichting scales were chosen because norm scores were available for children with normal hearing. The Reynell scale has 87 items which the child has to carry out assignments. The Schlichting scale assesses syntax development and vocabulary.

Spontaneous language

Spontaneous language was assessed in all six Dutch children at 12, 24 and 36 months after implantation. The spontaneous language of spoken Dutch was assessed with a hearing adult who used spoken language whereas spontaneous language of SLN was assessed with a deaf adult who used SLN. Transcriptions were made according to CHAT (Codes for the Human Analysis of Transcripts) conventions in Child Language Data Exchange System (CHILDES) and analysed using Computerised Language Analysis tools (Gilis, 1998; MacWhinney, 1984). Mean Length of Utterance (MLU) was calculated to measure complexity of syntax and was defined as the mean number of morphemes per utterance. Further, communication mode was coded in six categories: (1) fully spoken: a completely spoken utterance without signs; (2) fully signed: a completely signed utterance without spoken language; (3) fully signed, complementary spoken: a fully signed utterance of which a part is also expressed in spoken language; (4) complementary signed, fully spoken: a fully spoken utterance of which a part is also expressed in sign language; (5) supplementary signed, supplementary spoken: a partly spoken and partly signed utterance in which the spoken and signed part complement each other; (6) fully spoken, fully signed: the utterance is both fully spoken and fully signed (Van den Bogaerde, 2000).

Analyses

Auditory perception, speech intelligibility and spoken language development of Dutch children, earlier implanted Flemish children and later implanted Flemish children were compared using the Kruskal-Wallis test. When there was a significant difference, pair wise comparisons were made with Mann-Whitney U test. Pair wise comparisons between two variables were conducted with the Wilcoxon Signed Rank test.

Results

Auditory perception

Before and shortly after implantation, auditory perception was significantly better in the later implanted Flemish children (before CI MAIS: $p = 0.02$; 6 months after CI CAP: $p = 0.04$) compared to the other two groups. According to the CAP, 11 out of 18 children showed awareness of environmental sounds before implantation of whom six also responded to speech sounds. All children, except for one Dutch child, improved to the level that they could discriminate some speech sounds without lip-reading (n = 9), could understand conversations without lip-reading (n = 4) or could use the telephone with a known speaker (n = 4). Responses to sound in everyday listening situations also improved: before implantation the earlier implanted Flemish and the Dutch children hardly responded to sound in everyday listening situations. This is in contrast with the later implanted Flemish children who already had a 40 per cent of maximum score on the MAIS before implantation. Three years after implantation, most children reached the 90th per cent score of the MAIS.

Speech intelligibility

Speech intelligibility improved after children received their CI (see Figure 1). Before implantation, children mostly communicated with signs and gestures and if they used spoken language, their speech was hardly intelligible. Improvement tended to be faster in the Flemish children than in the Dutch children ($p = 0.10$). Three years after implantation, the Flemish children produced language that was intelligible for everyone, whereas the Dutch children were understandable if the listeners concentrate and lip-read.

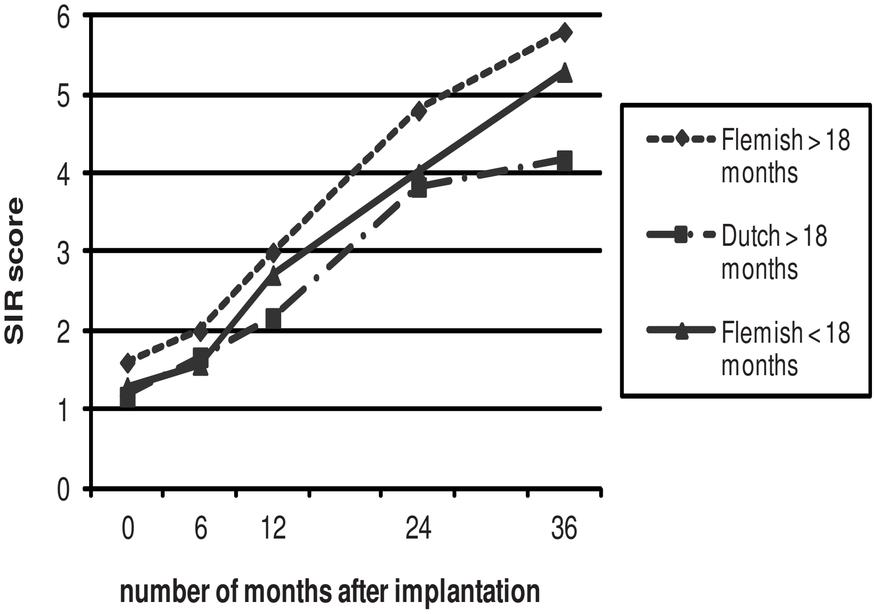

Figure 1. Speech Intelligibility Rating Scale (range 1-6)

Daily use of speech also improved: according to the parents (MUSS), children hardly made use of speech in daily communication before implantation, whereas most children reached the 90th per cent score three years after implantation. There were no significant differences between the three groups on the MUSS.

Spoken language

Figure 2 shows that receptive spoken language was better in the Flemish children than in the Dutch children, both at 24 and 36 months after implantation (Kruskal Wallis: 24 months, $\chi2$ (2, N = 18) = 10.71, $p < 0.01$; 36 months, $\chi2$ (2, N = 18) = 7.89, $p = 0.02$). Follow-up tests showed that both groups of Flemish children did significantly better than the Dutch children. Further, within the group of Flemish children, the earlier implanted children seemed to do better than the later implanted children, but the differences were not significant. Also, there was a significant difference in complexity of syntax (Kruskal Wallis: 24 months, $\chi2$ (2, N = 18) = 9.61, *p* < 0.01; 36 months, $\chi2$ (2, N = 18) = 7.08, *p* = 0.03). Follow-up tests showed that the earlier implanted Flemish children used more complex syntax than the Dutch children. The later implanted Flemish children did not differ significantly from both other groups. The same was true for active lexicon, where also only differences between the earlier implanted Flemish and the Dutch children were significant. Language development of the earlier implanted Flemish children seemed to be congruent with normal language development, whereas the Dutch children performed very poorly compared to their normal hearing peers.

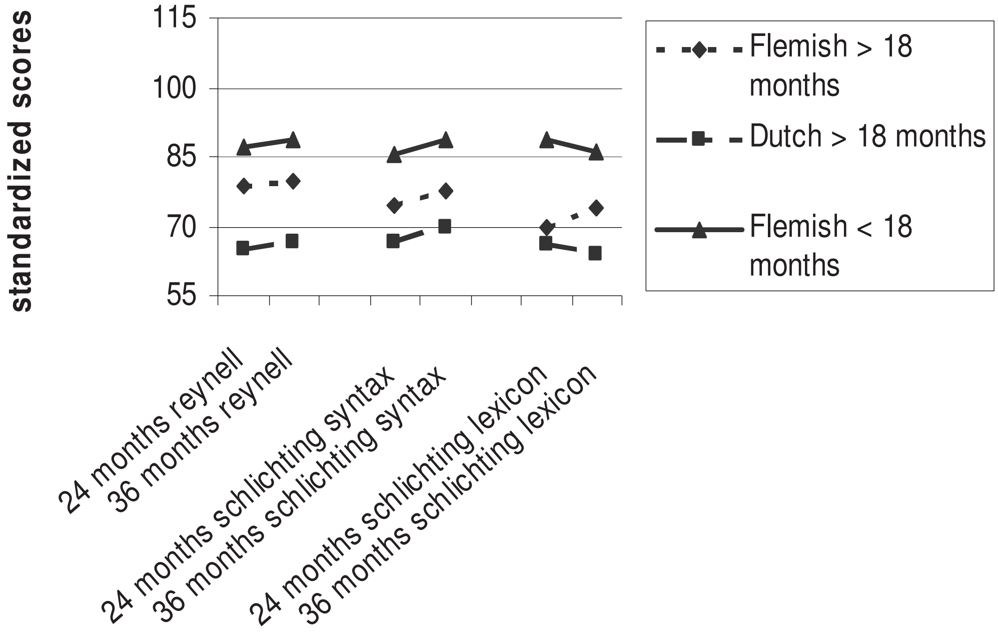

Figure 2. Receptive and expressive (syntax, lexicon) language (range 55-145)

Spoken language versus sign language in Dutch children
The Dutch children in this study showed progress in the MLUs in spoken language and thus in the complexity of syntax (Figure 3). Four out of six children showed great progress between the first and the third year after implantation, varying from 1.3 to 2.0. This means that these children used up to two more morphemes per utterance three years after implantation compared to one year after implantation. The other two children hardly made any progress. In contrast with this, the MLUs in sign language was stable during the three years of the project for all six children: none of the children made progress greater than 0.5. This implies that the complexity of syntax of sign language did not progress.

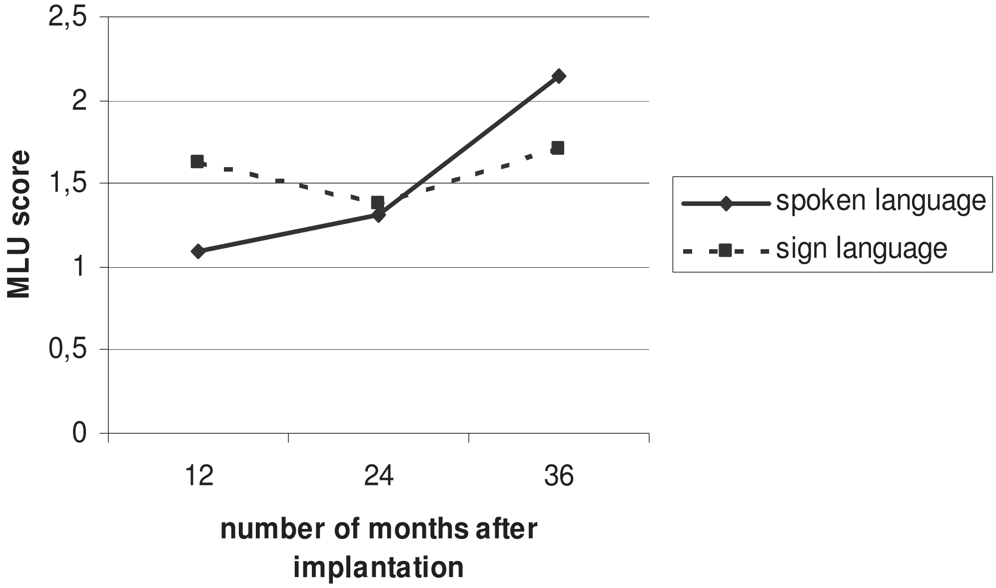

Figure 3. Mean Length of Utterance (MLU) in spoken language and in SLN in Dutch children (n=6).

Figures 4 and 5 show the communication mode used by the Dutch children when they were exposed to spoken language only (Figure 4) and sign language only (Figure 5). Only the categories 'fully spoken', 'fully signed' and ‘fully spoken, fully signed’ are represented in the figures, because the other three categories were rarely used by the children. This means that the Dutch children in this study hardly used supplementary and complementary modes to make themselves clear. Most utterances they used are fully spoken and/or fully signed. If children were exposed to spoken language only they merely used spoken language themselves and hardly used sign language. If they were exposed to sign language, they used more sign language than spoken language one year after implantation. In the course of time, they also used more and more spoken language even when the adult used sign language. They still used sign language, but more and more in combination with spoken language.

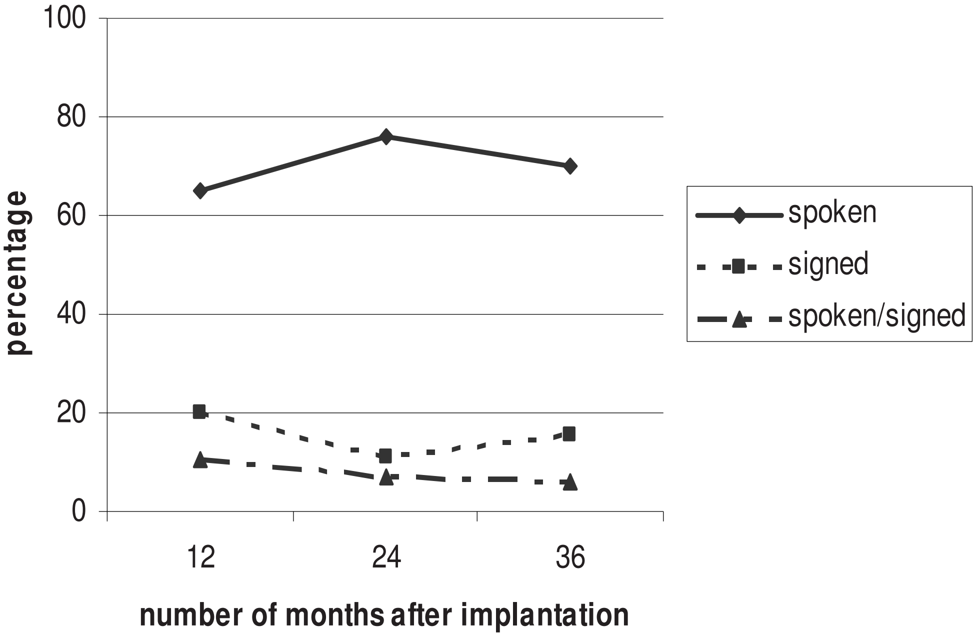

Figure 4. Communication mode in spoken language situation in Dutch children (n=6)

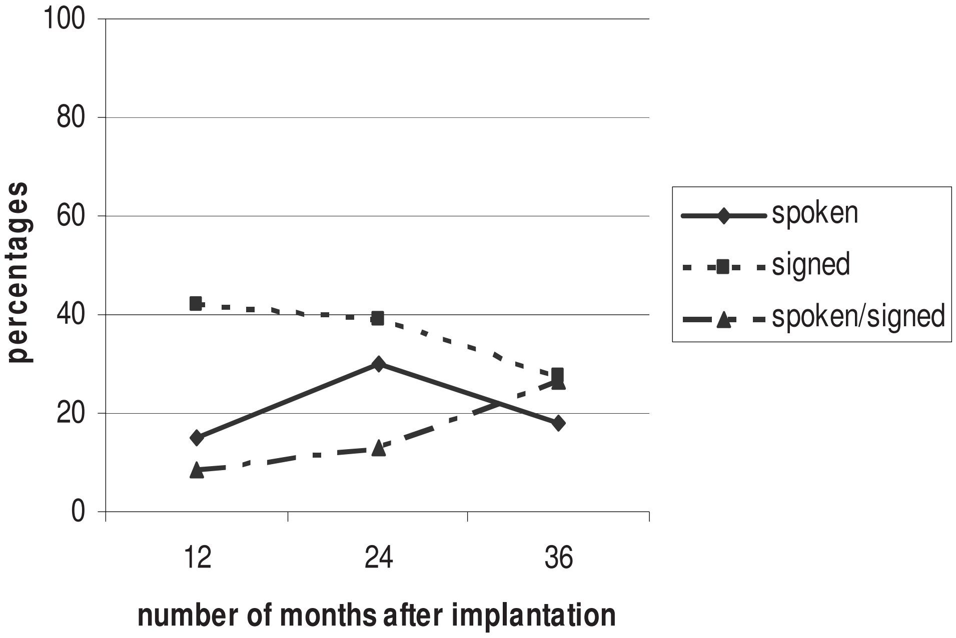

Figure 5. Communication mode in sign language situation in Dutch children (n=6)

Discussion

Auditory perception increased in all children: whereas most children hardly had any auditory perception before implantation, 36 months after implantation most children were able to understand daily conversations without lip-reading. Good auditory perception is a prerequisite for the development of spoken language. In general, the Flemish children in this study showed more progress in spoken language development than the Dutch children. Moreover, the earlier implanted Flemish children showed more progress than the later implanted Flemish children. This applies to auditory perception, speech intelligibility and spoken language. Whereas spoken language of the Dutch children improved in the course of time, the development of sign language in Dutch children did not show any progress. The results in the present study are consistent with earlier studies on the effects of CI on auditory perception and speech intelligibility (Anderson et al., 2004; McKinley and Warren, 2000; Thoutenhoofd et al., 2005) and on the effects of CI on spoken language development (Schauwers et al., 2004b; Svirsky et al., 2000, 2002b). The findings in the present study concerning spoken language are also consistent with earlier studies on differences of the effect of CI between monolingual and bilingual children (Geers et al., 2003; Kirk et al., 2002; Wie et al., 2007). Children in a dominantly monolingual educational setting seem to have better spoken language development than children in a bilingual educational setting.

Can the differences between the Flemish and the Dutch children in the development of spoken language be explained by the different language environment or by other factors?

One alternative explanation for the differences between the Flemish and the Dutch children in this study might be better aided hearing in Flemish children before implantation than in Dutch children. Correlational analyses showed that the level of aided hearing is associated with auditory perception and speech intelligibility after implantation: the more aided hearing before CI, the better auditory perception and speech intelligibility after implantation (CAP: $r = -0.51$; SIR: $r = -0.45$). The influence of aided hearing still seemed present three years after implantation: a significant correlation between the aided hearing before implantation and receptive and expressive spoken language three years after implantation was found (Reynell: $r = -0.50$; Schlichting syntax: $r = -0.48$). The findings in the present study are consistent with other studies. Svirsky et al. (2002a) showed that speech intelligibility of deaf children is associated with the level of aided hearing: children with more aided hearing had higher speech intelligibility. Further, Spencer (2004) found that better auditory perception before implantation was associated with the development of more complex syntax. Moreover, pre-operative hearing seems to be a better predictor of subsequent linguistic growth than age at implantation (Szagun, 2001).

Another explanation for the differences between the Flemish and the Dutch children in this study might be the received care and professional support. For instance, the Flemish children were diagnosed at a younger age (1–3 months) than the Dutch children (about 9–12 months) and therefore received a hearing aid at a younger age. Further, the Flemish children got professional support at a younger age than the Dutch children: at an average age of three months versus past the age of one year. The positive effect of early identification and early intervention has been indicated in several studies (Moeller, 2000; Yoshinaga-Itano, 2006). The Flemish children in this study not only received earlier intervention than the Dutch children, they also attended special daycare centres for at least six hours a day two or three days a week, whereas the Dutch children in this study went to preschool classes for three hours a day two days a week. After the age of 2.5 year, there were no differences in professional support: all children went to a special nursery school. Also, the Flemish children received immediate technical support when there was something wrong with their CI. This was not always the case for the Dutch children.

Despite these confounding factors, it is plausible that the differences between the Flemish and Dutch children in this study are partly caused by the linguistic environment. Because the Dutch children in this study learned two languages at the same time, it is normal that they show a different pattern of language development than the Flemish children. As Grosjean (1989) already pointed out, the communicative competence of bilinguals cannot be evaluated through only one language; it must be studied instead through the bilingual's total language repertoire as it is used in his or her everyday life. Because we studied spoken language and SLN separately, we could assess the development of both languages, but it was not possible to assess the communicative competence of the Dutch children.

The results of the present study indicate that spoken language in the bilingual children developed faster than in children using sign language. The complexity of syntax in SLN was stable during the three years of study, whereas progress was expected. This might be explained by the fact that the Dutch children in our study were more exposed to spoken language than to SLN. Although the parents of these children were taught SLN in courses, they were not fluent in it. Therefore, as soon as their children were able to understand spoken language, these parents communicated as much as possible in spoken language with their children, supported with signs when oral communication was not sufficient. Consequently, from one year after implantation, the input of SLN was almost completely restricted to day-care and/or (pre)school. The proportion of spoken language versus sign language changed in time to more spoken language. This might also explain why the Dutch children developed a preference for spoken language. But to be able to communicate fluently in sign language, as in any language, a child needs to live in an environment where adults and other children use sign language. This means that sign language should play an equally important role as spoken language in the life of CI children (Preisler et al., 2005). Also, it is essential for bilingual programmes that hearing parents and hearing teachers should reach fluency in sign language within a short time frame (Knoors, 2007). In a bilingual setting, there should be equal input of spoken and sign language. Special efforts have to be made for children to become fluent in sign language. It is therefore important to involve parents intensively, by teaching them SLN. If this is not possible, proper input of sign language should be realised within the school system, the family support system and the Deaf community (Nordqvist and Nelfelt, 2004).

Study limitations and strengths

This study yielded some new insights in the development of spoken and sign language in children with a CI. However, the results should be interpreted with some caution. Firstly, the number of children in the study was small. This means that only large differences between groups of children will be significant. Smaller probably relevant differences might not be significant. Still, we believe that the results are reliable because all the results point in the same direction and some of them were significant. Secondly, the children were followed-up for only three years. It is possible that spoken language development of the Dutch children in this study is only delayed at the onset and that they will catch up with the Flemish children in the course of time. But this is not likely, because research shows that children with a CI who show fast progress at an early stage continue to make faster progress as time passes, and those who show slow progress early on continue to progress slowly (Szagun, 2001).

A strength of this study is that we not only used standardised tests, but we also analysed the spontaneous language of children, spoken as well as sign language. Spontaneous language analysis provides information on the use of language in natural settings. Although MLUs may be overstating differences in complexity of syntax in the early stages of language acquisition, the development of the MLUs is consistent among the children. The MLUs for sign language for all Dutch children show hardly any progress, whereas the MLUs for spoken language improve in four out of six children.

Implications for practice

Considering possible alternative explanations it is not possible to conclude that children with CI should be educated in a bilingual or monolingual environment. Although the results of the study should be interpreted with caution, they are consistent to such an extent that it is possible to reflect on the optimal linguistic environment for children with CI. For parents, it is not possible to decide at an early stage whether the child with a CI should be raised monolingual or bilingual. The use of spoken language, supported by signs and visual communication strategies, offers parents the opportunity to postpone this decision and at the same time to communicate effectively with their young child. At a later stage, when auditory perception of the child is more clear, parents can decide whether their child will be raised in a dominantly monolingual or a bilingual environment. A child with poor auditory perception might be better off in a bilingual environment, whereas a child with good auditory perception might benefit from a monolingual environment. Then, the proportion of spoken language and sign language can be tailored to the chosen environment. In the case of monolingual education, the input of spoken language (supported with signs and visual communication strategies) might be increased. However, in a bilingual environment, with the objective that the child can participate in the hearing community as well as in the Deaf community, there should be equal input of spoken language and sign language. In that case it is also important to involve parents intensively, by teaching them sign language. If this is not possible, proper input of sign language should be realised within the school system, the family support system and the Deaf community (Nordqvist and Nelfelt, 2004).

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Chapter 4

Predicting social functioning in children with a cochlear implant and in normal-hearing children: the role of emotion regulation

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Abstract

Objective: The purpose of the present study was to compare children with a cochlear implant and normal hearing children on aspects of emotion regulation (emotion expression and coping strategies) and social functioning (social competence and externalizing behaviors) and the relation between emotion regulation and social functioning.

Methods: Parent-report questionnaires on language skills, social functioning and emotion regulation were uses, as well as emotion-regulation tasks in children. The study group consisted of 69 cochlear implant children and 67 normal hearing children aged 1.5 to 5 years.

Results: Cochlear implant children had fewer adequate emotion regulation strategies and were less socially competent than normal hearing children. The parents of cochlear implant children did not report fewer externalizing behaviors than those of normal hearing children. While social competence in normal hearing children was strongly related to emotion regulation, cochlear implant children regulated their emotions in ways that were unrelated with social competence. On the other hand, emotion regulation explained externalizing behaviors better in cochlear implant children than in normal hearing children. While better language skills were related to higher social competence in both groups, they were related to fewer externalizing behaviors only in cochlear implant children.

Conclusions: Our results indicate that cochlear implant children have less adequate emotion-regulation strategies and less social competence than normal hearing children. Since they had had their implants relatively recently, they might eventually catch up with their hearing peers. Longitudinal studies should further explore the development of emotion regulation and social functioning in cochlear implant children.

Introduction

Prelingual profound deafness has a great impact on children's social functioning. Because deaf children do not have access to sound, they have great difficulties in learning spoken language. As a consequence, deaf children have problems with aspects of social functioning, such as social competence and behavioral problems [1,2]. When exploring benefits of receiving a cochlear implant at a younger age, researchers found that poorer language skills in young deaf children were associated with more behavioral problems [2]. In another study it was suggested that the knowledge of display rules in deaf children was delayed due to reduced opportunities for early social interaction and communication experiences [1]. For the past two decades, hearing-impaired children have had access to sound through a cochlear implant (CI). A CI is a device that electrically stimulates the auditory nerve, bypassing the damaged part of the ear. Ultimately, signals from the auditory nerve are perceived as sounds by the brain. Today, up to 94% of young, profoundly deaf children receive a CI [3]. Remarkable results have been obtained with respect to speech and language outcomes, especially in children who received the implant early [4,5]. To date, however, the effect of a CI on children's social functioning is less clear.

Social functioning involves the ways in which children initiate and maintain relationships with meaningful others around them – a matter in which emotions play a crucial role. Social relationships that are truly adaptive depend largely on how children communicate their emotions – in other words, on their capacity for emotion regulation [6]. Emotion regulation is a skill that involves coping with emotions (i.e. internally regulating their intensity) as well as expressing them. It is thus the ability to moderate an emotion and to use coping mechanisms for its management (coping), thereby enabling it to be expressed appropriately (emotion expression). If effective, emotion regulation enhances social interactions [7,8].

Consequently, in typically developing children, adaptive emotion regulation is associated with good social functioning, in which social competence is high and behavioral problems are limited, which can be observed even in very young children [7,9,10]. Common adaptive emotion-regulation strategies in preschool children are avoidance and distraction: less distraction in early childhood was found to be related to rejection by their peers a few years later [11,12]. Another adaptive strategy in young children is to express fewer negative emotions; this is associated with fewer behavioral problems and more pro-social behavior [13].

To the best of our knowledge, little is known about the effect of a CI on children’s social functioning and about the relationship between social functioning and emotion regulation in CI children.

Our first objective was to compare CI children and normal hearing (NH) children on aspects of emotion regulation (emotion expression and coping strategies) and social functioning (pro-social skills and behavioral problems). Both emotion regulation and social functioning are related to language development in NH children, which is known to be delayed in young children with cochlear implants [14]. Therefore, we expected CI children, compared to their NH peers, to have less skills in emotion regulation (higher scores on negative emotion expression measures and lower scores on coping) and a lower level of social functioning (more behavioral problems and less pro-social behaviors).

The second objective was to examine separately in the two groups how these aspects of emotion regulation were inter-related to the two indices for social functioning). It was hypothesized that less expression of negative emotions and more expression of positive emotions would be related to better social functioning (fewer behavioral problems and more pro-social behaviors) in NH children. We also expected adequate coping strategies, such as distraction in frustrating situations, to be related to fewer behavioral problems and more pro-social behaviors in NH children.

Yet, our expectations regarding the strength of the relationships between emotion regulation and social functioning in CI children were less clear. While it might be equal to that in NH children, one might also hypothesize that emotion-regulation skills and social functioning are subject to developmental linguistic delays in CI children, and therefore may be less inter-related than in NH children.

Since social functioning and emotion regulation develop as children grow older and increase their communication skills, we included language measures in our analysis. It was hypothesized that better language skills would be related to better social functioning and more adequate emotion regulation strategies.

Methods

Participants

NH children and their parents were recruited through day-care centres and schools, and CI children were recruited through healthcare organizations. CI children from nine different counseling services and hospitals all over the Netherlands and one counseling service in the Dutch speaking part of Belgium were included. Seventy-one percent of the sample was recruited directly by health care professionals from one hospital and one counseling service. A response rate of 84% implies that this part of the sample is representative of the population of children with CI in the Netherlands. The remaining 29% of the sample was recruited via letters dispersed by the counseling services that participated in the study. The response rate was much lower, only 26% chose to participate. Since no information is available on the non-respondents, it is unknown whether this part of the sample is representative of the population. Informed consent was obtained from all parents, and the study was approved by the university's medical ethical committee. The total sample consisted of 136 children aged 1.5–5 years: 69 CI children and 67 NH children (table 1). All CI children were born to hearing parents, had profound prelingual hearing loss with no other disabling conditions, and all had had their implant before the age of 43 months, with one exception, who had received it at 57 months (range = 6–57 months). At the start of the study, the mean duration of CI use was 21 months; 83% of the children had had their CI for more than 10 months (range = 1–44).

The questionnaires were completed by parents of 104 children (N = 53 NH; N = 51 CI).

Table 1. Participant characteristics

	CI (n=69)	NH (n=67)
Mean age in months (SD)	41 (12.1)	44 (12.6)
Sex – n (%)		
Male	44 (64%)	36 (54%)
Female	25 (36%)	31 (46%)
CI characteristics		
Mean age at implantation in months (SD)	19 (9.7)	
Mean duration CI use in months (SD)	21 (12.2)	
Language skills (range 0–50)		
Mean receptive language score (SD)	31.0 (13.0)	39.3 (11.9)
Mean expressive language score (SD)	32.2 (12.6)	42.6 (10.7)
Motor development (range 0–23; 0–30)		
Mean score for gross motor skills (SD)	16.8 (4.0)	18.5 (3.8)
Mean score for fine motor skills (SD)	21.2 (6.1)	22.7 (5.8)

Materials

Parent questionnaires

General development was assessed using the Dutch version of the Child Development Inventory (CDI), a standardized instrument for children aged 15–72 months [15]. Parents answered the statements with “yes” or “no”. As it is very difficult to obtain reliable IQ scores in such young children, motor-development scales were used as an indication of cognitive development [16]. Because most deaf children have problems with their organ of balance [17], which is situated in the inner ear, seven items referring to balancing skills were removed from the gross motor scale. Although there were no significant differences regarding fine motor skills, CI children scored lower on gross motor skills than NH children did ($t(96) = 2.22$, $p = .029$). Language development – spoken and/or sign language – was assessed using the expressive scale and receptive scale from de CDI, each with 50 items. Items on both scales addressed syntactic, pragmatic, semantic, and intelligibility aspects. Examples of the expressive scale are “[he or she] calls or signs you ‘mama’ or ‘dada’ or a similar name” (age 6-12m),“uses at least five words or signs as names of familiar objects” (age 1-2), and “asks questions beginning with “why”, “when,” or “how” (age 3-4). Examples of the comprehension scale are “usually comes when called” (age 6-12m), “follows simple instructions” (age 1-2), and “talks about the future, about what is going to happen” (age 3-4). Because we were interested in the communication skills of children, parents were asked to answer “yes” when their child mastered the topic in either spoken or sign language.

Social functioning was assessed with the *SDQ,* a brief behavioural screening questionnaire [18], consisting of 25 items. Two scales were used for this study: Social Competence (10 items of the original scales Pro-social Action and Peers) and Externalizing Behaviours (10 items of the original scales Hyperactivity and Behavioral Problems). Parents can rate each item on a 3-point scale (0 = not true, 1 = somewhat true, 2 = certainly true). The internal consistencies of the scales are moderate to good (Table 2).

Table 2. Psychometric properties and mean scores of all questionnaires and tasks

	No. of items	Min-Max	Cronbach’s alpha		Mean scores (*SD*)	
			CI	NH	CI	NH
Emotion Regulation						
Coping						
Bottle Distraction*	4	0-2	.65	.52	.17(.32)	.29(.38)
Coping Task***	6	0-1	.87	.87	.05(.18)	.24(.33)
Emotion Expression						
Negative Reaction to Bottle	3	0-2	.68	.78	.27(.42)	.36(.46)
Negative Emotion Exp**	8	1-5	.71	.83	2.55(.40)	2.28(.53)
Positive Emotion Exp	6	1-5	.64	.76	3.63(.51)	3.53(.60)
Behavioural functioning						
Social Competence**	10	0-2	.76	.53	1.42(.36)	1.61(.23)
Externalizing Behaviors	10	0-2	.80	.66	.62(.40)	.51(.29)

p* (two-tailed) < .05; ** *p* (two-tailed) < .01; * *p* (two-tailed) < .001

Emotion expression was assessed with two scales from the *EEQ,* a 35-item parent-report questionnaire for measuring a child’s emotion expression

[19]. These scales were a) Negative Emotion Expression (8 items), which indicates the intensity and frequency of children's negative emotion expression and the extent to which they can calm themselves or be calmed by their parents when angry or sad; and b) Positive Emotion Expression (6 items), which indicates the extent to which children express happiness and joy. To complete these scales, parents rate the degree to which each item is true on a 5-point response scale (1 = (almost) never, 2 = rarely, 3 = sometimes, 4 = often, 5 = (almost) always). The internal consistencies of the scales are good (Table 2).

Observational measurements

The *Emotion Regulation Task* was designed for this study and examines children's responses to a frustrating event. The experimenter opens a bottle in front of the child, closes it again and then asks the child to open it. The child does not know that the bottle features a safety lock that makes it impossible for children to open. The experimenter waits for a minimum of 30 seconds and a maximum of 60 seconds, and then opens the bottle to an extent that will enable the child to complete the task successfully. During this waiting period, the experimenter scores the child's behavioural reactions on a checklist consisting of two scales. The first scale, the Bottle Distraction scale (4 items), is a coping scale that denotes the extent to which children can divert their attention from the negative stimulus. An example item is 'The child starts doing something else'. One item is formulated contra-indicatively ('The child keeps trying') and recoded. The second scale, the Negative Reaction to Bottle scale (3 items), is an emotion-expression scale that denotes the extent to which children show a negative reaction. An example item is 'The child shows a negative facial expression'. The experimenter can score the items on a 3-point scale (0 = not, 1 = a bit / unclear, 2 = clearly evident). The internal consistencies of the scales are moderate to good (Table 2).

The material for the *Coping Task* had also been designed especially for this study, and consisted of six vignettes depicting prototypical emotion-eliciting situations. Two vignettes were designed for each emotion (anger, sadness and fear). After children had been asked to look at the drawing and had been told, either in spoken language or in sign language, very simple illustrative words, such as "Boy sees dog", they were first asked to say or sign how the protagonist would feel. The children were then asked how the protagonist could become happy again (e.g., “How can boy get happy again?”). All responses were coded by two raters. Interrater agreement was good (Cohen’s Kappa varying from .91 to 1.00) and disagreements were resolved by discussion. Children’s scores were calculated as the proportion of appropriate coping strategies (e.g. ‘when dog leaves’ or ‘when boy leaves’). Children who were unable to perform a task because they did not understand ‘why’ questions received the score 0 for this task, meaning they could not perform this task.

Procedure

Children were tested individually in a quiet room. CI children who communicated only or partly in sign language were tested by a researcher who was familiar with spoken and sign language. More than half of the CI children (58%) were tested using some form of spoken Dutch combined with signs; 27% were tested using spoken Dutch, and 15% in sign language. All sessions were recorded on video and took approximately 20 minutes, including other tasks that are not presented in this manuscript. After the sessions, transcripts of the tape were made by the researcher.

Statistical analyses

All analyses were carried out with raw scores. Addressing our first hypothesis, group *t*-tests were carried out to compare CI and NH children with regard to the different aspects of emotion regulation and social functioning.

To test the second hypothesis, correlation analyses were used to establish the strength of the relationships between emotion regulation and social-functioning variables. Hierarchical regression analyses (method enter) were used to test the effect of language skills and aspects of Emotion Regulation on Social Functioning, with social competence and externalizing behaviors as dependent variables, and with emotion regulation measures (step 1) as independent variables. To examine the relationship of language skills with indices of Emotion Regulation and Social Functioning, language measures were entered in step 2 of the hierarchical regression analyses. These analyses were also repeated excluding children who had received their CI after their third birthday, those who had had their CI for less than 1 year, and those who were tested in sign language. There were no differences in outcomes between the analyses that included these participants and those that excluded them.

Because girls were slightly overrepresented in the NH children, group *t*-tests were carried out to compare boys and girls with regard to language skills and the different aspects of emotion regulation and social functioning. Boys and girls did not significantly differ on any of these variables and therefore, these outcomes are not further reported. Regression analyses were carried out including age as an independent variable. Results indicate that age did not contribute to the regression model. For reasons of clarity, the outcomes of these analyses are not included in the results presented below.

Results

Language skills

CI children had poorer receptive and expressive language skills than NH children (receptive: $t(92)=3.25$, $p=.002$; expressive: $t(88)=4.26$, $p<.001$) (table 1). In CI children and NH children alike, age and language skills were strongly correlated (Pearson correlation varying from .67 to .79; $p<.001$). In CI children, expressive language and duration of CI use were also strongly correlated ($r=.72$; $p<.001$), as were receptive language and duration of CI use ($r=.66$; $p<.001$).

Group differences regarding Emotion Regulation and Social Functioning

Group differences were found with regard to three aspects of Emotion Regulation. Table 2 shows that parents of CI children reported that their children expressed negative emotions more often and more intensely ($t(103)=2.92$, $p=.004$) than parents reported of their NH children. On the Bottle Distraction Task, CI children were less able than NH children in diverting their attention ($t(134)=2.01$, $p=.046$). On the Coping Task, CI children were barely able to invent ways the protagonist could become happy again, whereas NH children were more successful ($t(134)=3.97$, $p<.001$). Most CI children (68%) could not perform this task and fourteen CI children (20%) could perform the task but could not think of adequate strategies to become happy again. Only eight CI children (12%) could name one or more adequate strategies, whereas 30 NH children (45%) could do this. No differences were found concerning Positive Emotion Expression reported by parents and the Negative Reaction to Bottle Task.

Group differences were also found for Social Competence: parents of CI children reported lower social competence (*t*(102)=3.09, p=.003) than parents of NH children. There were no group differences for Externalizing Behaviour.

Table 3. Pearson's Correlation of language skills with Emotion Regulation and Social Functioning for CI children and NH children, controlled for age

	Receptive language		Expressive language	
	CI	NH	CI	NH
Coping				
Bottle Distraction	.10	-.05	.16	.07
Coping Task	.03	.06	.14	-.04
Emotion Expression				
Negative Reaction to Bottle	.27*	.09	.21	.11
Negative Emotion Exp	-.08	.12	-.07	-.05
Positive Emotion Exp	.06	.07	.09	.13
Social Functioning				
Social Competence	.64***	.49***	.61***	.41***
Externalizing Behaviors	-.27*	-.07	-.31*	-.06

p* (one-tailed) < .05; ** *p* (one-tailed) < .01; * *p* (one-tailed) < .001

Correlation and regression analyses

Pearson correlations of language skills with Social Functioning and Emotion Regulation, controlled for age, are shown in table 3. For Social Functioning, there were strong correlations in CI and NH children for both receptive and expressive language with Social Competence, even after controlling for age: children with better language skills also had better Social Competence. In contrast, language skills and Externalizing Behaviors were not correlated in NH children, whereas Externalizing Behaviors were moderately correlated in CI children for both receptive and expressive language skills. This shows that better language skills were associated with fewer Externalizing Behaviors. Language skills were not related with aspects of Emotion Regulation, except for Negative Reaction to the Bottle Task in CI children. However, language skills and some aspects of emotion regulation were correlated when we did not control for age, especially for aspects that require a verbal reaction of children (i.e. Negative Reaction to Bottle and the Coping Task). Pearson correlations for the subgroup of children who could perform the Coping Task revealed a correlation in NH children for receptive language and the Coping Task, but not in CI children.

Table 4 and Table 5 show the Pearson correlations between aspects of Emotion Regulation and Social Functioning for the CI children and the NH children, and the outcome of the regression analyses. The independent variables are Bottle Distraction, Negative Reaction to Bottle, Coping Task, Negative Emotion Expression, Positive Emotion Expression, receptive language, and expressive language. The dependent variables are Social Competence and Externalizing Behaviors. The results of both types of analyses are fairly similar, and the regression models show average to good explained variance, except for Social Competence in children with CI, for which neither model is significant. However, more Positive Emotion Expressions and more adequate Coping Strategies are strongly associated with better Social Competence in NH children, accounting for 26% of the variance (p=.004) in Step 1. After the subsequent entry of language measures in Step 2, the regression model accounted for 37% of the variance (p=.001). NH children's Coping Strategies were no longer associated with Social Competence. Although language measures were correlated with Social Competence in both CI children and NH children, they did not contribute significantly in the regression model.

In both groups, higher levels of Negative Emotion Expression was associated with more Externalizing Behaviors. Additionally, a stronger tendency to avoid the negative stimulus and turn away from it (Bottle Distraction) was associated with fewer Externalizing Behaviors in CI children. In contrast, higher levels of negative reactions in the Negative Reaction to Bottle Task were related to more Externalizing Behaviors in NH children. The regression model in explaining Externalizing Behaviors accounted for 38% of the variance (p<.001) in CI children, and 21% in the NH group (p=.015). The subsequent entry of language measures in Step 2 did not add significantly to the model.

Table 4. Pearson's Correlation and Hierarchical Regression Analysis predicting Social Competence for CI children and NH children

	CI (n=51)		NH (n=53)	
	R	*B*	*R*	*B*
Step 1	R^2=1%		R^2=26%**	
Coping				
Bottle Distraction	.17	.13	-.17	-.11
Coping Task	.01	.05	.39**	.33*
Emotion Expression				
Negative Reaction to Bottle	.12	.12	.11	.18
Negative Emotion Exp	-.21	-.20	-.06	-.06
Positive Emotion Exp	.05	-.03	.51***	.39**
Step 2	R^2=12%		R^2=37%***	
Coping				
Bottle Distraction		.18		-.05
Coping Task		-.10		.11
Emotion Expression				
Negative Reaction to Bottle		-.07		-.00
Negative Emotion Exp		-.23		-.06
Positive Emotion Exp		.08		.37**
Language				
Receptive language		.06		.63
Expressive language		.45		-.20

p* (one-tailed) < .05; ** *p* (one-tailed) < .01; * *p* (one-tailed) < .001

Table 5. Pearson's Correlation and Hierarchical Regression Analysis predicting Externalizing Behaviors for CI children and NH children

	CI (n=51)		NH (n=53)	
	R	*B*	*R*	*B*
Step 1	R^2=38%***		R^2=21%*	
Coping				
Bottle Distraction	-.31*	-.29*	.05	-.05
Coping Task	.14	-.04	-.21	-.19
Emotion Expression				
Negative Reaction to Bottle	.04	.08	.27*	.31*
Negative Emotion Exp	.54***	.56***	.34*	.34*
Positive Emotion Exp	-.20	-.11	-.12	.00
Step 2	R^2=44%**		R^2=17%**	
Coping				
Bottle Distraction		-.31*		-.07
Coping Task		.06		-.17
Emotion Expression				
Negative Reaction to Bottle		.19		.33
Negative Emotion Exp		.58***		.36*
Positive Emotion Exp		-.14		-.00
Language				
Receptive language		.02		-.23
Expressive language		-.29		.19

p* (one-tailed) < .05; ** *p* (one-tailed) < .01; * *p* (one-tailed) < .001

Discussion

Emotion regulation is an important skill for adaptive social functioning, which develops gradually during childhood. In NH children, it starts at a very early age. The outcomes of this study indicate that better social skills are indeed related to more expressions of positive emotions. Good social skills are further associated with the ability to intentionally reduce or divert the intensity of negative emotions for toddlers and preschool children with typical development. In contrast, we found more frequent and intense expressions of negative emotions, which imply less advanced emotion regulation skills, were related to more externalizing behaviors in these children. This is consistent with the literature [13, 20].

Differences between CI children and NH children

As we hypothesized, CI children were less socially competent and used less adequate coping strategies than NH children. Our study did not produce the widely observed differences between deaf and NH children regarding behavioral problems. However, most studies that found more behavioral problems in deaf children than in hearing children involved children aged 5 years or older [22,23]. It is possible that the difference between deaf and NH children with regard to the prevalence of behavioral problems starts when children enter school at the age of 4 or 5. Alternatively, it is possible that deaf children who receive a CI at a relatively young age do not have more behavioral problems than NH children. A study of deaf adolescents with CI showed that while they did not have more behavioral problems, they seemed to have more peer problems – a finding that is consistent with our results[24]. A third explanation might be that parents of a child with CI experience more communication problems with their child [25]; such interactions might easily result in more frustration on both sides. Future studies should therefore consider externalizing problems in higher age-groups, and also examine the extent to which children's behavioral problems are related to the quality of interpersonal communication.

Emotion regulation in relation to social functioning

The question is to which extent the capacities for emotion regulation in children with a CI are also related to adaptive social functioning (e.g. better social skills and fewer externalizing problems). In both CI and NH children, more intense and more frequent expressions of negative emotions were related to more externalizing behaviors. For CI children, however, more distraction from a negative stimulus was a protective factor. Surprisingly, even though CI children were reported by their parents to express negative emotions more often and more intensely than NH children, and even though they were less able to divert their attention from negative stimuli than their NH peers, they did not show more externalizing behaviors. Alternatively, children with a CI might be more expressive when emotionally evoked, which might have caused an over-report by their parents. Yet, the fact that parents did not report more arousal for positive emotions combined with the absence of a group difference for negative emotion expression during the task, contradicts this alternative explanation. Nevertheless, future studies could assess emotion regulation in different ways, using a more elaborate multi-method approach. For example, measuring the level of arousal by means of skin-conductance could show if children with CI are indeed more emotionally aroused during an emotion evoking episode and how this level of arousal is related to their communicative and social skills.

We found children with CI to be less socially competent than NH children. Furthermore, none of the indices used for emotion regulation in this study were related to social skills in CI children, where some were related to social skills in NH children. The coping task in which children were asked to spontaneously think of how protagonists could improve their negative emotions, puts an especially high verbal demand on children. This difficulty explains why very few children in the CI group could perform this task. However, expressions of positive emotion were also unrelated to better social skills in children with CI. This lack of relationship implies that these children make less strategic use of their positive emotions in order to maintain or enhance their relationships with meaningful others – a behavior that was also observed in older deaf children [26]. This might be explained by the fact that emotion socialization in young CI children differs from that of hearing children. Young CI children have less models and partners with which to practice emotion regulation. They lack this opportunity because most parents with deaf children do not know how to sufficiently practice these skills when communicating with their children [26, 27]. The parenting styles of parents with a deaf child also differ from those of parents with NH children. For example, parents with a deaf child are more likely to use physical discipline in response to perceived child transgression [28]; Physical punishment models other social rules for these children – probably none of which enhance deaf children's emotion regulation. If this is true for CI children, this could signify that social competence develops differently in children with CI than it does in NH children. This could further indicate that deaf children with CI are unaware of the valuable function of emotion in their social interactions.

The role of language

In our sample, the role of language skills in emotion regulation was different than we had expected. Although language skills were related to indices for emotion regulation, these associations disappeared after controlling for age. This may have been a product of the types of tasks that were used in this study. Expressing emotions and distracting oneself from negative stimuli does not require language skills. The emotion-regulation task that put a strong verbal demand on children – the coping task – was in fact too difficult for two thirds of the CI children and one third of the NH children. It would be interesting to assess associations between language skills and indices of social functioning and emotion regulation for the small group of children that could perform the coping task. However, the sample in our current study was too small to do this. As other studies have shown the importance of language in more advanced emotion-regulation strategies [21], it is plausible that language skills become more important as children grow older. Future studies should therefore examine these strategies in CI children and the relationship with language skills.

As hypothesized, we found a strong relationship between better language skills and higher social competence. Our results that the NH children in our study not only had better language skills than CI children, but also higher social competence further supports this claim. Obviously, aspects of social competence, such as interaction with peers and pro-social behavior, require good language skills. Despite the strong correlation between language skills and social competence, language skills did not contribute significantly to the regression model in either CI or NH children. This implies that other variables, e.g. emotion socialization, might be a greater influence on social competence than language skills.

Note that language skills in this study were assessed through a parent-questionnaire, whereby it is not possible to differentiate between detailed aspects of language skills such as syntactic and phonological complexity. However, this study was conducted to compare CI children with NH children on aspects of emotion regulation and social functioning and the relationship between these two factors. The assumption was that language skills would have an indirect relationship with social functioning via aspects of emotion regulation. For this, measures concerning daily use of language, either spoken language, sign language, or a combination of these two, are probably more valid than detailed information on spoken language skills in a test situation. We did not include information on auditory perception for similar reasons. Auditory perception is highly related to the ability to acquire spoken language skills [29], and influences emotion regulation and social functioning through language skills. Moreover, auditory perception in the Netherlands is mainly assessed using speech perception tests in quiet, often leading to ceiling effects [30].

Conclusion

CI children aged 1.5-5 years differed on some aspects of emotion regulation and social functioning from their normal hearing peers. They were less socially competent, less able to divert their attention and invent ways to become happy again, and expressed negative emotions more often and more intensely. In contrast with our expectation, CI children did not have more behavioral problems than NH children, probably explained by the fact that the children in our study were relatively young. In accordance with our hypothesis, associations between aspects of emotion regulation and social competence were different for CI children compared to NH children. None of the emotion regulation indices were associated with social competence in CI children. In NH children, adequate coping strategies and positive emotion expression was associated with social competence. Additionally, more expression of negative emotions was related to externalizing behavior in both groups, whereas the ability to distract attention in frustrating situation was associated to externalizing behavior in CI children. The influence of language skills on emotion regulation and social functioning was unclear, probably due to their young age. Especially in CI children, but also NH children, coping skills and emotion expression are not well developed in early years.

In sum, it appears that children with CI, when compared to NH peers, display more features of emotional dysfunctioning that are known to contribute to externalizing behaviors in typically developing children, although this is not yet evident in more externalizing problems. Nevertheless, because externalizing problems are more common in CI children at an older age, longitudinal studies should examine the causal relationship with the indices identified in this study. It also appears that adaptive abilities, such as coping skills and the communication of positive emotions, are not yet evident in CI children at this young age. Hopefully, after longer CI use, longer exposure to the hearing world, and greater experience of it, these children will catch up with their NH peers. However, there is no such evidence as far as we know. It is possible that if basic emotion regulation strategies do not develop well in the early years of life, children will always have sub-optimal regulation strategies. Again, future research is needed to study this possibility. Cochlear implantation is occurring more frequently at even younger ages. This trend might influence the outcome for future children favorably, as it does regarding language development. Once again, longitudinal studies might further explore the role of protective factors in the social development of children with CI.

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Chapter 5

Emotion Understanding in Deaf Children with a Cochlear Implant

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Submitted

Abstract

The effect of a cochlear implant on emotion understanding is still largely unknown, especially with regard to young children and those who received a cochlear implant at an early age. We examined various indices for emotion understanding and their associations with language development in children aged 2.5-5 years, both normally hearing children (N=52) and deaf children with a cochlear implant (N=57). Two aspects of emotion understanding were tested: i) emotion recognition in facial expressions, and ii) emotion attribution in a situational context. Emotion recognition was assessed by two tasks examining children's ability to discriminate and identify different facial emotion expressions. An emotion-attribution task examined the extent to which children were able to attribute emotions to a protagonist in prototypical emotion-evoking situations. On all emotion-understanding tasks children with a cochlear implant were less proficient than children with normal hearing. In children with normal hearing performance and language skills were positively associated; in children with cochlear implants language was positively associated only with tasks in which a verbal demand was made on children. These findings indicate that the impairment of children with a cochlear implant affects all aspects of emotion understanding we had measured, including their non-verbal emotion-understanding skills. Auditory input seems essential for non-verbal abilities, such as recognizing facial emotion expressions. On the basis of these outcomes it is not possible to conclude whether emotion understanding development in children with a cochlear implant is merely delayed, or qualitatively different from that in peers with normal hearing. Since the CI children received their implants relatively recently, they may yet catch up with their hearing peers.

Introduction

Emotions play an important role in daily life: the way they are understood and expressed influences social relationships, the way people act in difficult situations, and the way interpersonal conflicts are solved. In children and adults alike, problems in emotion understanding have been shown to be related to developing symptoms of psychopathology or poor social functioning in adults (Eisenberg, Spinrad, & Eggum, 2010). For instance, in children social competence, peer-rated popularity, and academic achievement are strongly related to the ability to recognize the facial expression of emotions in other people, and to understand the causes of these emotions (Denham, McKinley, Couchoud & Holt, 1990).

Because there are also strong indications that language plays an important role in emotion understanding as well (Bosacki & Moore, 2004), the well-documented delays in deaf children's language development make it particularly difficult for these children to develop proper emotion understanding (Moeller, Tomblin, Yoshinaga-Itano, McDonald Connor & Jerger, 2007; Meerum Terwogt & Rieffe, 2004; Rieffe & Meerum Terwogt, 2000; Rieffe & Meerum Terwogt, 2006). As from the late 1990s deaf children can have access to sound via a cochlear implant (CI), a device that electrically stimulates the auditory nerve, bypassing the damaged part of the ear. Ultimately, signals from the auditory nerve are perceived as sounds by the brain. Today, up to 94% of young, profoundly deaf children receive a CI (De Raeve & Lichtert, 2011). Remarkable results have been obtained with respect to speech and language outcomes, especially in children who received the implant at a young age (Niparko, Tobey, Thal, Wang, Quittner, & Fink, 2010; Colletti, Mandalà, Zoccante, Shannon & Collettie, 2011), and many implanted children are even able to attend mainstream schools (De Raeve & Lichtert, 2011). To date, however, the effect of a CI on children's emotion understanding has not been examined.

In this study we examined two aspects of the ability to understand emotions in young deaf children with a CI: emotion recognition in facial expressions, and emotion attribution in a situational context. We assessed this ability for the four basic emotions: happiness, anger, sadness, and fear (Vicari, Reilly, Pasqualetti, Vizzotto & Caltagirone, 2000).

Emotion recognition in facial expressions

An understanding of the facial expression of emotions comes about through the interplay between neurobehavioral maturation and environmental influences (McClure, 2000). Neurobehavioral research has shown that while the amygdala plays a prominent part in the recognition of faces in very early development, later a central role may be played by cortical areas. According to social constructivist theory, social interaction is important for the development of a proper understanding of the facial expression of emotions (McClure, 2000). The most important processes for developing recognition of facial expressions are children's exposure to, and modeling from adults (McClure, 2000).

In the process of recognizing the facial expression of emotions two phases are distinguished. First, children must be able to *discriminate* between different facial expressions. In other words, they must be able to see that there is a difference between a drawing of a woman with a happy expression and a drawing of the same woman with a sad expression. However, the ability to discriminate between those two faces does not imply that the child also knows that these differences concern two different emotional states. Second, children must be able to *identify* and *label* the facial expressions – they have to associate the facial expression with the corresponding emotion (McClure, 2000).

The development of facial-expression recognition is impaired by deficits in both maturational and experiential factors. While deficits in maturational factors in children include those of Autism Spectrum Disorder (ASD; a neurodevelopmental disorder characterized by deficits in emotional and social interaction) (American Psychiatric Association, 2000), most deaf children have problems with experiential factors, because parent-child interactions are less frequent, shorter and less conversational than they are with hearing children (Gray, 2007). According to Hosie, Gray, Russell, Scott & Hunter (1998), research on the lateralization of face-processing abilities suggests that the emotional development of deaf children may differ from that of hearing children, probably because their exposure to and modeling from adults deviates from that of hearing children. However, it is unknown how this difference affects deaf children's recognition of the facial expressions of emotions.

Because deaf children spend less time communicating with their parents and cannot overhear conversations in which they are not directly involved, one possible consequence is that they are more sensitive to the facial expression of emotions (Barker, Quittner, Fink, Eisenberg, Tobey & Niparko, 2009). In general, deaf children are more dependent on visual information than hearing children, for instance because face patterns are essential for sign language, and many words share the same sign but with different facial expressions (Ludlow, Heaton, Rosset, Hills & Deruelle, 2010). Another consequence might be that deaf children have difficulties in acquiring the skills needed to recognize the facial expression of emotions, because this skill usually develops within the auditory and linguistic contexts. Young children with normal hearing not only observe the facial expressions of others, but also listen to others in order to learn how such expressions are interpreted. Deaf children do not get this verbal information. Their lack of exposure to daily conversation deprives them of models who facilitate their development (Rieffe & Meerum Terwogt, 2006).

Nowadays, however, most deaf children in Western countries receive a cochlear implant (CI) before their second birthday (De Raeve, 2010). By giving them access to sound, a CI makes it possible for them to learn spoken language more easily. Since there is a positive relation between language development and emotion understanding (Bosacki & Moore, 2004), these children can be expected to develop a better understanding of emotions than deaf children without a CI. To date, only few studies have examined facial emotion discrimination in CI children (Hopyan-Misakyan, Gordon, Dennis, & Papsin, 2009; Wang, Su, Fang, & Zhou, 2011). Hopyan-Misakyan et.al. (2009) showed that, when asked to match photos with drawings of facial emotion expressions (happiness, anger, sadness, and fear), a group of ten-year-old children who had received their CI prelingually were indeed just as accurate as their hearing peers in discriminating between different facial expressions. However, normally hearing preschool children performed significantly better on facial expression recognition than CI children, suggesting that there is a delayed development in children with CI (Wang et al., 2011).

Emotion attribution in a situational context

The recognition of other people's emotions does not depend solely on facial expressions. Observers can attribute emotions correctly only when they know the antecedents of the emotion expression – i.e., they can correctly predict an emotion only when they have some knowledge about the situational context in which the emotion is expressed. Therefore, besides the ability to recognize emotions in facial expressions, it is equally important for children to develop knowledge about the kinds of situations that typically evoke a certain type of emotion.

In prototypical situations, most hearing four-year-olds can correctly attribute the basic emotions to a protagonist (Rieffe, Meerum Terwogt, & Cowan, 2005). In contrast, a study by Gray, Hosie, Russell, Scott & Hunter (2007), showed that deaf children aged 5-8 years found it considerably more difficult to assign emotions to prototypical situations than their hearing peers. The ability to understand the basic emotions in a prototypical situational context has not yet been studied in CI children.

This study

The aim of our study was to compare the capacity for emotion recognition and emotion attribution in prototypical situations between young normally hearing (NH) and CI children aged 2.5-5 years. We also examined the relation between emotion recognition/attribution and language development. Today, up to 94% of young, profoundly deaf children are fitted with a CI (De Raeve & Lichtert, 2011), making it difficult to compare CI children with deaf children who did not receive a CI. Therefore, we included in our study NH children and prelingually deaf children with a CI. First, by being asked to match drawings of various facial expressions to counterparts showing a similar expression, all children were required to discriminate between two different emotional facial expressions: 1) positive versus negative facial expressions, and 2) angry versus sad facial expressions. For this task, no language skills were required and children were instructed non-verbally. Second, the children were asked to identify emotions by linking words denoting emotion to facial expressions of happiness, sadness, anger, and fear. Third, they were asked to attribute emotions to a protagonist in various prototypical situations.

We expected CI children to be able to discriminate between different facial expressions as well as NH children could, because no language skills are needed in this task. Moreover, deaf children generally depend more on visual information than do NH children (Ludlow et.al., 2010), thus developing more sophisticated nonverbal skills. Hence, we expected CI children to perceive the difference between a happy and a sad face just as well as NH children did.

We also expected CI children to perform less well than NH children in identifying facial emotion expressions and attributing emotions in prototypical emotion-evoking situations. This is because the identification of emotions is related to language development, which in CI children has repeatedly been shown to be delayed in the first few years of life (Colletti, 2009).

Method

Participants

The total sample consisted of 57 CI children (34 males, 23 females, aged 2.5 – 5 years, mean age = 46 months, SD = 8.6) and 52 NH children (30 males, 22 females, aged 2.5 – 5 years, mean age = 47 months, SD = 10.2). All CI children were born to hearing parents, had profound prelingual hearing loss with no other disabling conditions, and all had had their implant before the age of 43 months, with the exception of one child, who had received it at 57 months (range = 6 - 57 months, M = 20, SD = 10.1). At the start of the study, the mean duration of CI use was 25 months; 85% of the children had had their CI for more than 12 months (range = 1 – 44, SD = 11.3).

NH children were recruited through day-care centers, playgroups, and primary schools in the Netherlands. CI children were recruited through hospitals and family counselling services in the Netherlands and the Dutch-speaking part of Belgium. Informed consent was obtained from all parents and the study was approved by the university’s medical ethical committee.

General development was assessed by means of the Dutch version of the Child Development Inventory, a standardized instrument for children aged 15-72 months (Ireton & Glascoe, 1995). As an indication of cognitive development motor development scales were used, since it is impossible to obtain reliable IQ scores for children this young (Piek, Dawson, Smith, & Gasson, 2008). Because deaf children usually have problems with the organ of balance (Gheysen, Loots, & Van Waelvelde, 2008), situated in the inner ear, five items referring to balancing skills were removed from the gross motor scale. The questionnaires were filled out by parents (N = 36 NH; N = 39 CI). No significant differences were found for fine motor skills, but CI children scored lower on gross motor skills than NH children did ($t(71) = 2.45$, $p = .02$).

Materials

Emotion recognition in facial expression. Two tasks were used to assess emotion recognition in facial expression: a discrimination task and an identification task.

First, children's ability to discriminate between different facial emotion expressions was examined in the *Emotion-Discrimination Task,* consisting of two conditions, each covering two performance tasks of increasing difficulty. In the first, neutral, condition children were tested on their ability to discriminate between: 1) cars versus flowers, and 2) faces with hats versus faces with glasses. This condition was also used to check whether the children understood what they were expected to do. The second, facial expression condition was designed to test children's ability to discriminate between different facial emotion expressions: 1) positive versus negative expressions, and 2) angry versus sad expressions. The task was stopped if children did not produce correct responses for the first condition. In both conditions children had a sheet in front of them with a sample drawing of one category in the top left corner (e.g., a car) and a drawing of the other category in the top right corner (e.g., a flower). The children were then handed six cards in fixed order (three drawings of a car and three drawings of a flower) and non-verbally asked to place each card on the correct side of the sheet. The drawings of facial emotion expressions used in this task were all computer-generated, in black and white, and based on photos of three- and four-year-old boys (Figure 1). The cards that were placed correctly were counted, with a maximum of three per category.

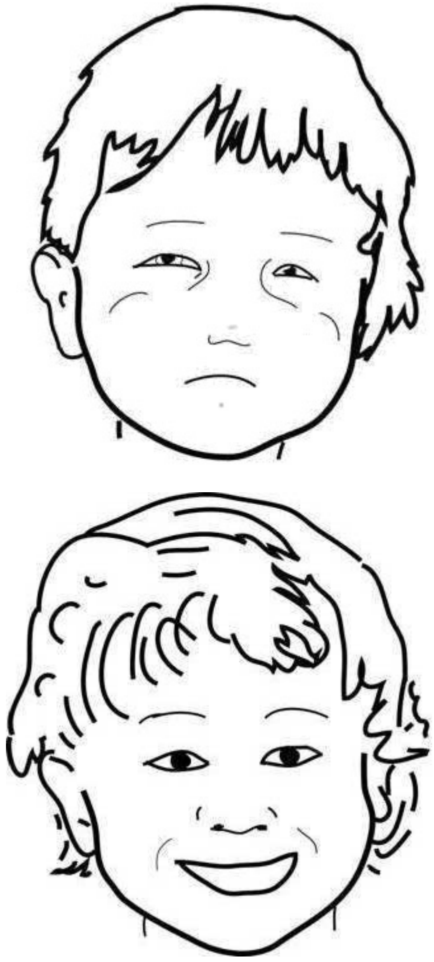

Figure 1.
Examples of facial-emotion expressions (negative and positive) for the Emotion-Discrimination Task

Second, in order to examine the children's ability to link emotion words to the facial expressions accompanying the four basic emotions (happiness, sadness, fear, and anger), they were presented with the *Emotion Identification Task*, consisting of eight drawings of facial emotion expressions, two for each emotion, designed especially for this study. The researcher asked the children: "Who looks happy?" and they had to point to the drawing with the correct facial expression. Next, the researcher asked: "Is there anybody else who looks happy?" After that, she repeated the same procedure for anger, sadness, and fear.

The number of emotions identified correctly was recorded, with a maximum score of two per emotion. Next, the scores for negative emotions (anger, sadness, fear) were combined into one mean score. The scores for positive and negative valence were used in the analyses.

Emotion attribution in prototypical situations. The material for the third task, the *Emotion-Attribution Task,* consisted of eight vignettes depicting prototypical emotion-eliciting situations; these, too, had been designed especially for this study. For each basic emotion (happiness, anger, sadness and fear), two vignettes were designed.

After the children had been asked to look at the drawing and had been offered, either in spoken or in sign language, very simple illustrative words, e.g., “Boy sees dog”, they were first asked to say or sign how the protagonist would feel (verbal condition), and then to point to the drawing with the correct facial expression (visual condition). Their scores were calculated as 1) the proportion of correct verbal predictions, and 2) the proportion of correct visual predictions. A correct answer was achieved when a child predicted an emotion with the intended valence, i.e., negative (anger, sadness, fear) versus positive (happiness).

The children were then asked to explain why the protagonist would feel that emotion (e.g., “Why is boy scared?”). All responses were coded by two raters. Interrater agreement was 98.7% and disagreements were resolved by discussion. Children’s scores were calculated as the proportion of correct emotion explanations.

Language development. Language development – spoken and/or sign language - was assessed on the basis of the Dutch version of the Child Development Inventory (Ireton & Glascoe, 1995), which consists of two language scales – an expressive scale and a comprehensive scale – of 50 items each. Examples of items on the expressive scale are “calls/signs you ‘mama’ or ‘dada’ or a similar name” and “uses at least five words/signs as names of familiar objects”. Examples of items on the comprehension scale are “usually comes when called” and “follows simple instructions”. Parents answered the items by yes or no.

Test procedure

Children were tested individually in a quiet room. CI children who communicated wholly or partly in sign language were tested by a researcher who was familiar with spoken and sign language. More than half of the CI children (53%) were tested by means of some form of spoken Dutch combined with signs, 29% by spoken Dutch, and 18% by sign language. No differences in performance were found on any of the tasks concerning language mode. All sessions were recorded on video and took approximately 20 minutes, including other tasks, which are not presented in this paper. After the sessions, the researcher made transcripts of the tapes.

Data analysis

Children who were unable to perform a task received a score 0 for that particular task, because this means that they were not able to correctly recognize facial expressions and attribute emotions. To determine whether accuracies in the recognition of facial expressions and the attribution of emotions in prototypical situations differed between NH children and CI children, all scores were entered in a multivariate analysis of variance. Effect sizes are also reported: Effect sizes around .01 are viewed as small, around .06 as medium and around .14 as large (Cohen, 1988). These analyses were also repeated excluding children who had been unable to perform one or more of the tasks, children who had received their CI after their third birthday, and children who had had their CI for less than one year. There were no differences in outcomes between the analyses including, and those excluding these participants. Furthermore, all analyses were also carried out by gender and age. According to Miller and Chapman (2001) this is only legitimate when the covariates (gender and age) and groups (CI/NH) are independent, and when assignment to group is based on the scores of the covariates. Both assumptions were fulfilled in our study, since CI children were matched with their hearing controls on age and gender. No differences were found in this respect either. For reasons of clarity, these analyses are not included in the analyses presented below.

Results

Emotion recognition in facial expression

Emotion Discrimination. Table 1 presents means and standard deviations of children's performances on the Emotion-Discrimination Task. Children's scores for the neutral condition were analyzed with a 2 (Group) x 2 (Difficulty) analysis of variance. A main effect was found for Difficulty ($F(1,107) = 25.50$, $p < .01$), both groups finding the flower/car task easier than the glasses/hat task. There was no significant difference between NH children and CI children.

Children's scores for the facial expression condition were analyzed with a 2 (Group) x 2 (Difficulty) analysis of variance; this revealed main effects for Group ($F(1,107) = 5.12$, $p = .03$) and Difficulty ($F(1,107) = 29.70$, $p < .01$). First, we found that CI children were not as proficient as NH children at sorting faces that expressed emotion. Second, it was more difficult for children in both groups to distinguish between emotions within the negative domain (sadness and anger) than across valence domains (positive and negative). There were no other significant outcomes. Eight children were unable to perform this task: two NH children and six CI children.

Table 1. Mean score of correct responses and standard deviation for the Emotion-Discrimination Task as a function of hearing status (range 0-3)

	CI children (n=57)	NH children (n=52)	partial η^2	Total
Neutral condition				
Flower/car	2.57 (0.88)	2.79 (0.67)	.019	2.67 (0.79)
Glasses/hat	2.22 (1.02)	2.42 (0.86)	.012	2.32 (0.95)
Facial-expression condition				
Positive/negative	1.50 (1.11)	1.89 (0.92)	.037	1.69 (1.04)
Sad/Angry	1.06 (1.03)	1.47 (0.99)	.040	1.26 (1.03)

Emotion Identification. Table 2 presents the accuracy with which children identified the positive and negative facial-emotion expressions. A 2 (Group) x 2 (Emotion) analysis of variance revealed main effects for Group ($F(1,107) =$

21.02, p = <.01) and Emotion (F(1,107) = 19.73, $p < .01$), which were qualified by an interaction of Group x Emotion (F(1,107) = 20.62, $p < .01$). For Positive and Negative emotions alike, NH children performed better than CI children in linking emotion words to facial expressions. Post-hoc t tests also showed that NH children performed better on Positive emotions than on Negative emotions – a difference that was not found in CI children. Five NH children and 23 CI children were unable to perform this task, which means that they were unable to link emotion words to drawings depicting emotions. Post-hoc t tests showed that the mean age of children unable to perform the task was younger than for those able to perform the task (t(107) = 4.11, $p < .01$). All hearing children unable to perform this task were less than three years old; the age of the CI children varied from 2,5 – 5 year. No other differences were found (Bonferroni correction was applied).

Table 2. Mean score of correct responses and standard deviation for the Emotion-Identification Task and the Emotion-Attribution Task as a function of hearing status (range 0-2)

	CI children (n=57)	NH children (n=52)	partial η^2
Emotion-Identification Task			
Positive facial expression	0.82 (0.93)	1.71 (0.64)	.237
Negative facial expression	0.83 (0.82)	1.18 (0.62)	.055
Emotion-Attribution Task			
Verbal prediction	0.20 (0.31)	0.66 (0.37)	.323
Visual prediction	0.41 (0.43)	0.71 (0.38)	.113

Emotion Attribution in prototypical situations

Children's scores for the prediction of emotions in prototypical situations were analyzed by means of a 2 (Group) x 2 (Mode: Verbal, Visual) analysis of variance (Table 2). Main effects were found for Group (F(1,107) = 31.99, $p < .01$) and Mode (F(1,107) = 23.28, $p < .01$), which were qualified by an interaction of Group x Mode (F(1,107) = 11.06, $p < .01$). Post-hoc t tests showed that NH children performed better than CI children on both the verbal condition (predicting the emotion using language, either sign or spoken) and the visual condition (pointing to a drawing of the correct facial expression). Whereas CI children performed better on visual than on verbal prediction, there was no difference between the modes of prediction in NH children. Because five NH children and 23 CI children were unable to perform the Emotion-Identification Task, we did not assess the Emotion-Attribution Task in these children, assuming that they would not be able to perform this more complicated task.

A *t* test was conducted to analyze differences in explanations of the predicted emotion between the two groups. More correct explanations were given by NH children (M = .62, SD = .39) than by CI children (M = .19, SD = .34), ($t(107) = 6.04$, $p < .01$). The same outcome was produced by excluding the data for the children who had given no explanation.

Associations with background variables

Pearson correlation was used to analyze the relation of language development (both expressive and comprehensive) to the Emotion-Discrimination Task, Emotion-Identification Task, and Emotion-Attribution Task. Table 3 shows that Emotion-Attribution Tasks were significantly correlated with expressive and comprehensive language development. For CI children and NH children alike, expressive and comprehensive language capacities were related to the Verbal Prediction and Explanation parts of this task. CI children differed from NH children in one respect: their expressive and comprehensive language was not related to the Visual Prediction part of the Emotion-Attribution Task. Language development was not significantly associated with emotion identification or emotion discrimination.

The age at which CI children had had their implant did not correlate with any of the emotion-understanding indices. Although the length of time since receiving their CI was correlated with all emotion-understanding measures, none of these significant correlations remained after control for chronological age.

Table 3. Correlations between language skills with all emotion tasks as a function of hearing status

	NH children		CI children	
	Expressive language	Language comprehension	Expressive language	Language comprehension
	Emotion-Discrimination Task			
Positive/negative	.23	.37*	.06	.16
Sad/Angry	.11	.24	.07	-.05
	Emotion-Identification Task			
Positive facial expression	.16	.31*	.24	.18
Negative facial expression	.28	.49**	.09	.14
	Emotion-Attribution Task			
Verbal prediction	0.47**	0.59**	0.47**	0.44**
Visual prediction	0.57**	0.67**	0.13	0.22
Explanation	0.51**	0.59**	0.40*	0.37*

* p<.05; ** p<.01

Discussion

In this study we examined the ability of 2.5 to 5-year-old deaf children with a cochlear implant to recognize and attribute emotions in prototypical situations. We included only the basic emotions (happiness, sadness, anger, and fear), since these are the first that children learn to recognize (Denham, 1998). Overall, CI children performed less well than their normally hearing peers. CI children were less proficient than NH children in emotion recognition in facial expressions, both discriminating and identifying, and in attributing emotions to a protagonist in prototypical situations. Although the use of language in the tasks was kept to a minimum, the results of CI children were impaired on all measures, even when no verbal demands were made on the children.

Some CI and NH children failed to perform certain tasks. In the Discrimination Task, for example, they started playing with the cards instead of sorting them; in the Attribution Task, there were questions they did not answer they did not answer a question, with more CI than NH children failing to participate. In both groups these children were younger than the children who were able to perform the task. After the scores of the 'failing' children had been excluded from the analyses, the differences between CI and NH children remained. While the length of time since receiving the CI was related to all outcomes in CI children, these associations were absent after control for chronological age. In NH children language comprehension was associated with better performance on all tasks, but in CI children only with performance on the two tasks in which the children were expected to respond verbally (either orally or in sign language).

Importantly, CI children fell behind their hearing peers, even in non-verbal tasks. In the Emotion-Discrimination Task, for example – in which children were asked to sort cards showing facial emotion expressions for emotion valence (positive versus negative) and for two emotions within the negative domain (anger versus sadness) – CI children performed less well than NH children. This is not in line with our expectation that both groups of children would perform equally well. However, CI and NH children performed equally well in the neutral, non-emotional condition (sorting cars and flowers, or distinguishing between faces with hats or with glasses), which emphasizes the fact that children did understand the task well. In fact, the discrepancy in outcomes between the two neutral conditions versus the two emotion conditions suggests that it is not understanding the task that is problematic for deaf children – even if they have a CI -, but discriminating between two different facial expressions.

Additionally, in line with our expectations, it was not only the recognition of facial expressions of emotion that was more difficult for CI than NH children, but also the interpretation of the emotional valence in prototypical emotion-evoking situations. Again, this task could be performed non-verbally. When children were shown a drawing displaying an emotion-evoking event, asked (in either oral or in sign language) which emotion the protagonist would feel, and shown pictures of facial emotion expressions they could point to, CI children again were outperformed by their hearing peers. Nevertheless, they did slightly better when they could point to one of the facial expressions depicting an emotion than when asked to produce the emotion word or sign.

The question is whether the differences we found between CI and NH children indicate delayed emotion understanding due to delayed language skills, or rather stem from a qualitative difference in development. The outcomes on the Discrimination Task may hint at delayed development, since CI children were outperformed by NH children, but both groups were more proficient at discriminating between domains (positive versus negative) than within one emotion-valence domain (anger versus sadness). This is consistent with other research (Vicari et.al,2000; Gao & Maurer, 2009). Conceivably, a positive facial expression can be distinguished from a negative one by its unique mouth pattern; in other words, happiness can be recognized by merely a smile. In contrast, discriminating between negative facial expressions, such as anger, fear, and sadness, is more demanding because it requires the integration of both the upper and lower face (Vicari et.al., 2000).

On the other hand, the outcomes on the Emotion-Identification Task do not indicate whether the development of CI children is delayed or qualitatively different. In line with other research, NH children in this study mastered the identification of positive emotions such as happiness before that of negative emotions (Vicari et.al., 2000; Gao & Maurer, 2009), but CI children performed equally poorly on both valences. Because professionals and other people dealing with CI children need to know whether or not the development of these children is qualitatively different from normally hearing children, this is an issue that in future studies might be examined more closely. For example, if CI children do indeed develop differently, emotion indices might be expected to have a different adaptive or maladaptive function, and thus to contribute differently to the development of psychopathology symptoms than they do in NH children. Gaining insight into the developmental pattern of emotion understanding in CI children might help professionals in training these children in emotion understanding skills in order to prevent the development of psychopathology.

Taken together, our findings indicate that CI children's emotion understanding is negatively influenced by their deafness, even when a task does not directly require language skills. The fact that CI children also fell behind their NH peers on a non-verbal task in recognizing emotional expressions in faces emphasizes that a social context is crucial for children's emotional development, or so-called "emotion socialization" (Saarni, 1999). The delay in emotion understanding in CI children might be explained by lower exposure and less modeling from adults before they received their CI and had no access to spoken language. By using a longitudinal design, future studies might examine possible developmental pathways, thus shedding more light on the causal relation between language development and children's emotional functioning. Possibly, CI children "catch up" with their hearing peers when they have had the benefit of their implant for a longer period. Children in this study had been implanted for a relatively short time, due to their young age. This study is only a first step towards increasing our understanding of the effect of deafness and language development on children's emotional development. This might be relevant not only to the group with a CI, but also to other clinical groups with language or communication impairments, such as children with specific language impairments or an autism spectrum disorder. Future studies could examine the extent to which the outcomes of this study indeed also apply to other groups with language delays.

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Chapter 6

Discussion

General discussion

The aim of this thesis is to provide more insight into some of the aspects that affect the daily functioning of children with a CI and into environmental factors that influence their development. We have therefore focused on 1) the influence of parents on these children's daily functioning, 2) the influence of language mode on their language development, and 3) the influence of a CI on their social-emotional functioning.

The picture that emerges from this work is that the language development and social-emotional development of young children with a CI in the Netherlands lags behind that of their normally hearing peers: standardized tests (Chapter 3) and parent reports (Chapters 4 and 5) all showed that these children's receptive and expressive language skills were poorer. This is consistent with a recent study by Niparko et al. (2010), who found that gaps in spoken-language development between children with a CI and normal-hearing children were still evident three years after implantation. But while children with a CI also used less adequate emotion-regulation strategies and were less socially competent than their hearing peers, parents did not report more behavioral problems (Chapter 4). As Chapter 5 shows, development in emotion understanding was delayed in children with a CI, who were less proficient in discriminating and identifying the facial expressions that accompany the four basic emotions (happiness, sadness, anger, and fear). They were also less proficient in attributing emotions in prototypical situations.

Another finding of this thesis is that language development and social-emotional development vary widely in children with a CI. This is consistent with the literature (Spencer, 2004; Thoutenhoofd, Archbold, Gregory, Lutman, Nikolopoulos & Sach, 2005; De Raeve, 2010). In some children, language development is similar to that of normally hearing children. Some others barely acquire spoken language at all. As shown by the larger standard deviations in children with a CI, something similar applies to social-emotional development: while some children failed to participate in the tasks, others performed relatively well.

How can we explain such wide varieties in their development? According to Bronfenbrenner's social-ecological model (1979), children's development is influenced not just by child characteristics, but also by a child's immediate and wider social environment. For children with a CI, age at implantation is known to be particularly important. On average, spoken language is better in those who receive their CI before the age of eighteen months than in those who receive it later (Niparko, Tobey, Tahl, Wang, Quittner & Fink, 2010; Chapter 3).

Intrapersonal and interpersonal factors can also be identified in this respect. This thesis has identified some factors in these children's immediate and wider social environment which not only affect their functioning, but have not to our knowledge been studied in depth before.

Parental influence on CI children's daily functioning and development

The experiences of Turkish parents of deaf children with a CI in the Netherlands showed clearly that wider social support systems are not tailored to their needs when they learn that their child is deaf (Chapter 2 of this thesis). As the values and beliefs of Turkish parents differ greatly from those of Dutch family counselors and other healthcare professionals in the Netherlands, support for Turkish families is less than optimal, and the language development of deaf Turkish children is delayed (Wiefferink, Vermeij, Van der Stege, Spaai & Uilenburg, 2008).

The effects of the differences between Turkish parents and Dutch healthcare professionals become evident soon after diagnosis, when parents have to make important decisions on hearing-rehabilitation. Many Turkish parents did not trust the diagnosis that their child is deaf, or find it difficult to accept the deafness of their child. This may delay the uptake of hearing-rehabilitation, which was confirmed in an earlier study showing that, on average, Turkish children receive a CI nearly a year later than their Dutch peers (Wiefferink, et al., 2008).

Turkish parents also experience difficulties in being actively involved in the care of their deaf child. These findings are in line with a study by Steinberg et.al. (2003), who reported that parents from minority groups in the USA found it difficult to make decisions on the care of their deaf child, and that these difficulties might be due to cultural differences.

Influence of language mode on the language development of children with a CI

In the Netherlands, those in the immediate and wider social surroundings of children with a CI are unable to create a truly bilingual climate for them. As a result, the spoken language development of Dutch children with a CI lags behind that of their Flemish counterparts, who are raised in a monolingual environment. Moreover, as soon as these Dutch children acquire spoken language, sign language did not progress any further (Chapter 3 of this thesis). Theoretically, a bilingual environment may be the best option for deaf children with a CI, for despite their CI, these children do not have normal hearing. They still experience problems when they have to take off their CI (e.g. when swimming or at night) or when they are in a noisy classroom. Under such circumstances, sign language may help them.

In practice however, it seems infeasible to raise young children with a CI bilingually. As soon as they can communicate with their child in spoken language, hearing parents of such children are much less motivated to learn sign language, and rely more on spoken language (Archbold, Nikolopoulos, Tait, O'Donoghue, Lutman & Gregory, 2000; Nordqvist & Nelfelt, 2004; Preisler, Tvingstedt & Ahlström, 2005). Because these children are thus exposed to sign language only at preschool or school, their exposure to spoken language exceeds their exposure to sign language. Due also to a preference for spoken language in most children with a CI (Wheeler, Archbold, Gregory & Skipp, 2007), it is difficult for many of them to master sign language at a level adequate for their daily interactions.

Currently, this conflicting situation between the desired linguistic environment (bilingual) and the real linguistic environment (spoken language only) is recognized by parents, professionals working with deaf children (e.g. teachers and family counselors), and members of the deaf community. However, two different positions are taken regarding how to deal with this situation.

The first position is that, due to the changes in deaf children's environment brought by neonatal hearing screening and cochlear implants, the linguistic environment of deaf children with a CI should be reconsidered (Knoors, 2011). Knoors (2011) states that it should be accepted that most parents of deaf children with a CI choose to communicate with their child in spoken language and that professionals should facilitate this choice.

The other position is that deaf children with a CI should have a right to bilingualism. This position is usually taken by members from the deaf community and by hearing people involved in this community. At 'Sign Languages as Endangered Languages', a conference organized by the deaf community in Norway in November 2011, it was noted that the status of sign languages is under threat in Denmark and the Netherlands.

Which position is in the best interest of the deaf child with a CI? Seen from the perspective of the social-ecological model, a child's development is directly influenced by the quality and quantity of interaction between children and parents, teachers, and peers. Similarly, through these parents, teachers, and peers, it is influenced indirectly by those in the wider social environment, such as the deaf community, schools, and healthcare organizations. Regardless of ideological, philosophical or theoretical issues, this environment should help parents, teachers, and peers to optimize their interaction with these children.

To create an optimal linguistic environment for these children and their parents, healthcare professionals first have to determine what would be the best linguistic environment for each specific child, taking account of child characteristics, the parent's characteristics, and the immediate social environment. Next, they should help parents to create this optimal linguistic environment through counseling and parental training, and through educational placements that provide the child with the best possible linguistic environment.

Influence of CI on children's social-emotional development

Language skills are associated with social-emotional development: better language skills are related to better social-emotional development. This is as true for normal-hearing children as it is for those with a CI. Although the studies on social-emotional development described in Chapters 4 and 5 are based on cross-sectional data, assumptions about causality can be formulated only on the basis of our theoretical knowledge of overall development. Statements on causality are therefore hypothetical and should be further tested in longitudinal research. The results presented in this thesis indicate that because language development in young children with a CI is delayed, their social-emotional development is also likely to be delayed. In turn, through the quality and quantity of their interactions with parents, teachers, peers, and others, their language development is probably influenced by those in their immediate social environment. As described above, it is also influenced by factors in their wider social environment.

However, the studies in Chapters 4 and 5 also revealed some noteworthy differences between children with a CI and hearing children with regard to the relationship between language and social-emotional development. In both groups, expressive and comprehensive language skills were related to verbally attributing emotions to prototypical situations and explaining why the protagonist felt that emotion. However, in prototypical situations in which children were asked to point at a drawing with the correct facial expression, the language skills of children with a CI were unrelated to emotion-attribution – unlike in normal-hearing children, in whom the two were strongly correlated. Similarly, in normal-hearing children, comprehensive language skills were related to the ability to correctly identify facial emotion expressions; in children with a CI they were not. This suggests that language helps normal-hearing children to develop their ability to recognize facially expressed emotions, but that it does not help children with a CI. It is thus possible that language is a prerequisite for properly interpreting facial emotional expressions. If so, this might explain why children with a CI unexpectedly fell behind their hearing peers in a nonverbal emotion-recognition task. These outcomes also imply that factors other than language skills are important for children's emotional development.

A crucial factor in addition to language is children's so-called emotion socialization. Emotion socialization refers to how the immediate environment affects the development of emotion understanding and emotion regulation in young children (Morris, Silk, Steinberg, Myers & Robinson 2007). Chapter 1 describes how emotion socialization in deaf children differs from that in normally hearing children – the product of less exposure to and modeling by parents, and of more problems in the interactions between parents and their deaf child. A further cause lies in the fact that the parenting styles of parents of deaf children are generally poorer than those of parents of normal-hearing children.

While less is known about emotion socialization in children with a CI, it is reasonable to assume that, in the first years of their life, before they have access to spoken language, it does not differ much from that in deaf children without a CI. As the children studied in this thesis were still very young, their social-emotional delay may have been caused by these early differences in emotion socialization.

The fact that emotion socialization develops different in children with a CI and normally hearing children, may also differently affect the social functioning of children with a CI. Social functioning refers to the ability to interact and form relationships with others (Denham, Blair, DeMulder, Levitas, Sawyer, Auerbach-Major & Queenan, 2003) and a healthy emotional development is crucial to this. This was confirmed in our study for normally hearing children. The outcomes of the study described in Chapter 4 showed that more positive emotion expression and more adequate coping strategies were strongly associated with better social competence. However, we did not find the same associations between emotional functioning and social functioning in young children with a CI. As stated in Chapter 4, this implies that social competence develops differently in children with a CI than in normally hearing children, indicating that young deaf children with a CI seem less aware of the function of emotion in social interactions as was also evident in older deaf children (Rieffe & Meerum Terwogt, 2006).

Taken together, the studies described in this thesis indicated that the emotional and social development of children with a CI differs from that of normally hearing children. Our findings indicate that CI children's social-emotional development is negatively influenced by their deafness, even when a task does not require language skills. The fact that children with a CI also fell behind their normally hearing peers on non-verbal tasks emphasizes that a social context is crucial for children's emotional development. The delay in social-emotional development in CI children might therefore be explained by poorer language skills and lower exposure and less modeling from adults before they received their CI.

Implications for professional practice

In the view of the author, the results of these studies have implications for healthcare professional's practice; these are outlined below.

Parental influence and involvement

Seen from a social-ecological perspective, the cultural values and beliefs in the immediate environment of a deaf Turkish child differ from those in the wider social environment, in this case the Dutch one. In order to create the best possible developmental environment for deaf Turkish children in the Netherlands, it is important that family counselors, teachers, and healthcare professionals are aware of these differences and find ways to overcome them. One way to do this is to empower parents in a way that enables them to create a better developmental environment for their deaf child.

Family counselors can play an important role in the empowerment of parents, for they are the link between the different systems in which a child functions, such as the family, preschool, audiological center and hospital. They are also counseling the family immediately after the diagnosis. Possibly the first duty of family counselors is to find ways to convince parents that their child is permanently deaf and that it is essential to start hearing rehabilitation as soon as possible. If they are unsuccessful in this, they have to be aware of other strategies, such as referral to a Dutch-Turkish ENT physician, or involving other Turkish parents with deaf children who can share their experiences. By involving people from the same cultural background who also have experience with deaf children, the parents might be helped to accept the deafness of their child.

Family counselors also can help Turkish parents to optimize the developmental environment for their deaf child with a CI. For this, they and the parents have to discuss the prerequisites for creating this environment, and whether the parents are able to meet them. One of the problems faced by some

Turkish families is that they are not fluent in spoken Dutch, which makes it difficult for them to use this language to communicate with their child. The counselors have to encourage parents to decide at an early stage what will be their child's home language: spoken Dutch, spoken Turkish, or both. Once this has been decided, the counselors can help the parents to learn how to communicate with deaf children, and how signs, body language, and facial expressions can be used in their interaction with them in the chosen language or languages. If the parents are unable to create an optimal developmental environment for their CI child, the family counselors should discuss with them how their immediate social environment, such as relatives and neighbors, can help them to do so. One way to organize and formalize this is through a Family Group Conference, an intervention that empowers parents to regain control over their lives.

Because of the global growth of immigration, it becomes more important to tailor care to the needs of other cultural groups. Empowering parents so that they are able to create a better developmental environment for their deaf child is a method that can also be used for other cultural groups that experience difficulties with the Dutch health care system. However, the strategies that have to be used to empower parents might differ between cultural groups due to differences in values and beliefs.

Linguistic environment

Children's development is directly influenced by the quality and quantity of their interpersonal interactions with parents, teachers, and peers (Bronfenbrenner, 1979). To enhance the quality and quantity of these interactions between children with a CI and their parents, teachers and peers, it is important that everyone involved in the communication enjoys it. If the interactions are enjoyable for both parties, they will communicate more. To achieve enjoyable communication, parents – as soon as the diagnosis is known – have to start learning basic skills regarding communication with their deaf child. These include spoken language, signs, facial expression, and visual cues.

As soon as children have a CI and have access to sound, it is important for them to be exposed to spoken language. Family counselors have to support parents in the use of spoken language after implantation. At first, because the child’s spoken language is still delayed, they should support spoken language with signs. After a year, the child’s spoken language skills should be assessed. Then, on the basis of his or her language development, professionals and parents should together decide how to continue. If the child is making good progress in spoken language, parents can stimulate his or her language development by increasing their communication in spoken language. If there is no or little progress in spoken language, the parents should be advised to continue to communicate in spoken language supported with signs, or to switch to Dutch Sign Language.

However, parents are not the only people who have interpersonal interaction with the CI child: others – such as relatives, peers, and teachers – also interact with the child and therefore influence its development. These people should also be involved in creating the best possible developmental environment. In the Netherlands, this means that counseling organizations, schools, and preschools should differentiate more than they do at present.

Finally, for children with a CI who are raised bilingually but do not benefit enough from their CI to catch up with spoken language, it is important to create an environment in which they are exposed equally to spoken language and sign language. This means that schools, universities, and other organizations have to offer intensive sign language programs to parents and teachers.

Stimulating social-emotional development

To facilitate healthy social development in children with a CI, parents and other adults in the child’s immediate social environment have to actively teach them emotional and social skills. Social-emotional competence in early childhood involves several skills, such as the awareness and expression of affect, emotion identification, situational knowledge, and emotion regulation (Domitrovich, Cortes, & Greenberg, 2007). The lack of these skills has been associated with peer rejection and internalizing and externalizing behavior (Domitrovich, et al., 2007).

There are various ways in which parents and other adults in the immediate environment can stimulate the development of these skills. First, they can teach the child how to recognize and understand emotions by discussing them. When the child shows an emotion, the parent can ask how he or she feels and why he feels that way; in this way, the child can learn to understand what kind of feelings are evoked in certain situations. This can also be done when reflecting on past situations, for example when looking at photographs of a birthday or other affective situations.

The second way is by parents and other adults making their own emotions more explicit by telling their child how they feel, and why. They also can show their child how they regulate their feelings, and which strategies they use to improve their emotional well-being.

Third, social competence can be stimulated by helping the child to understand how others feel in prototypical situations, how to give a compliment, how they can solve an argument with peers, and so on. Parents and other adults can do this by explicitly showing their child their own social interactions, but also by discussing the child’s social behavior.

For parents, these are not customary things to do: in most families, emotion socialization happens unconsciously, because normal hearing children overhear how adults understand and regulate emotions and how they act in social situations. Parents should thus be supported by family counselors in how to do this.

Education in social-emotional skills should also be provided at school and pre-school. In the Netherlands, several curricula on social-emotional development are available for primary and secondary schools. One of them is Promoting Alternative Thinking Strategies (PATHS), which was found to positively affect social-emotional development (Kam, Greenberg, & Kusché, 2004; Paulussen, 2008). For Dutch preschools, there are no such programs for children aged less than four. Since the delay in social-emotional development starts at a very early age, programs on social-emotional development should be developed for these very young children.

Future research

This thesis shows that the linguistic and social-emotional development of young deaf children with a CI lags behind that of their normally hearing peers. As the age at implantation is still decreasing – a factor that has proved to be an important factor in children’s early spoken-language development – it is unclear how these young implanted children will develop when they are older. To date, studies on the development of older children have involved children who received their CI when they were older than the current generation of newborn deaf children. Further study should thus examine how the young implanted children such as those described in this thesis will develop when they are older. First, longitudinal studies should determine whether the language and social-emotional development of children with a CI catches up with that of their normally hearing peers as they are exposed longer to the hearing world. Second, longitudinal studies are needed to further explore the role of language and emotional competence in the social functioning of children with a CI.

In addition, more extensive study should be devoted to the influence of those in the immediate and wider social environment on the development of children with a CI. This thesis has examined only two aspects of the wider social environment and its relation to the development of children with a CI: the influence of the linguistic environment and the influence of cultural values and beliefs of one minority group. This means that our findings on Turkish parents and their deaf children cannot be generalized to other minority groups in the Netherlands, such as Moroccans. Other studies have shown that non-western immigrants generally experience problems with the healthcare system in their new country, varying from problems in making rehabilitation decisions to the accessibility to healthcare (Eldering, Adriani, Hamel & Vedder, 1999; De Graaf & Eitjes, 2004; Steinberg, Delgado, Bain, Li & Ruperto, 2003; Stern, Yueh, Lewis, Norton & Sie, 2005). Yet, cultural values and beliefs are likely to vary between minority groups. Insight into the specific problems of different minority groups would be gained by a larger study that included parents and deaf children in other minority groups. This would provide fuller understanding of the influence of cultural differences in the immediate and wider social environment on the development of deaf children with a CI.

Emotion socialization is another aspect of the social environment that deserves detailed study. This thesis has shown that the emotional development of children with a CI lags behind that of their normally hearing peers. Studies on the emotion socialization of children with a CI and how parenting styles affect this, might explore whether there are differences in emotion socialization and parenting styles between children with a CI and normally hearing children that can explain the differences in both language and social-emotional development.

Final conclusion

It can be concluded from this thesis that language development and social-emotional development of young children with a CI in the Netherlands are delayed compared to those of their normally hearing peers. Since the development of children with a CI is influenced by factors in their immediate and wider social environment, it is important that a broader approach be taken to creating an environment that stimulates these children's development. To gain insight into the protective and risk factors for each child, their immediate and wider social setting should be mapped out. Only when these factors are known will it be possible to create an optimal developmental environment for them.

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Summary / Samenvatting

Summary

Between 150 and 200 deaf children are born in the Netherlands each year. Deafness has major consequences for these children's development, as it deprives them of access to spoken language. As a result, interaction between these children and their parents – most of whom are hearing – is often difficult. Good interaction between parents and children is important to development, particularly language, intellectual, and social-emotional development.

Since the 1990s, deaf children have been able to have a cochlear implant (CI). A CI is a device that electrically stimulates the auditory nerve, bypassing the damaged part of the ear. A microphone transmits sounds to a speech processor, which converts them to electrical pulses that are then transmitted to the auditory nerve through electrodes on an array implanted in the cochlea. Ultimately, signals from the auditory nerve are perceived as sounds by the brain. Thus, a CI not only restores hearing, it also gives a patient the ability to experience sound – and to communicate.

Currently, some 95% of all children who are born deaf or with serious hearing loss are given a CI. But while each CI promises to have a profound effect on a child's language development, there are big differences between individual children. While some children with a CI appear to develop in nearly the same way as hearing children, others appear to have little benefit from their CI.

Various factors are known to have a positive influence on the development of these children. One important factor is the age at which a child undergoes cochlear implantation: below the age of eighteen months, implantation has a positive effect on language development. Another important factor is the extent to which parents are involved in the rehabilitation process: if this is high, the effects are positive. However, the degree to which other factors – including cultural and social factors – affect the development of children with a CI is not clear.

The questions central to this thesis concern the way in which a CI affects children's development, and the factors that play an important role in this. The framework for this thesis is provided by Bronfenbrenner's social-ecological model , which proposes that children's development is influenced by the quality and quantity of their interpersonal interactions with their parents and the other

people around them. These interactions are influenced indirectly by the direct environment in which children live, and also by the ideological, political and cultural patterns of society.

Against this background, we explored three specific aspects of development in children with a CI:

1. The influence of parents on these children's daily functioning,
2. The influence of language mode on their language development, and
3. The influence of a CI on their social-emotional functioning.

In **Chapter 1** Bronfenbrenner's social-ecological model is explained in more detail using these three aspects.

The results described in **Chapter 2** show that parents of Turkish origin living in the Netherlands experience problems with regard to caring for a deaf child. One striking finding is that many parents initially find it difficult to believe that their child is deaf. Another is that these parents had little faith in the Dutch healthcare system – something that became apparent during the interviews, when it was revealed that over half of them had traveled to Turkey to consult a Turkish doctor for a second opinion.

It was also shown that communication between parents of Turkish origin and care providers was not always optimal: Turkish parents' approach to decisions about the treatment and care of the child seemed to be diametrically opposed to that of care providers. In the Netherlands, care providers are used to giving parents objective information – including the benefits and disadvantages of the various options – that will help parents make the decisions themselves. Turkish parents seem not to like this approach: as the care provider is supposed to be the expert, they want to be presented with the best solution to the problem. They may thus have high expectations of the care that can be provided. Disappointment often follows, especially if examinations (which parents tend to find unclear and protracted) produce no clear conclusions. This may partly explain parents' low level of trust in the Dutch care providers. Whatever the case, low trust has negative consequences for deaf children of Turkish origin, who, on average, were shown to get a CI nearly a year later than Dutch children.

In retrospect, some Turkish parents regretted that their child had not been given a CI at an earlier age; they saw that other children who had been fitted with a CI at an earlier age had developed better than their child. Care providers should thus anticipate such regret when helping parents decide on the hearing-rehabilitation process and CI. Another option is to refer parents to a physician of Turkish origin who is working in the Netherlands; this might avoid the waste of valuable time when asking for a second opinion.

Chapter 3 compares the language development of Dutch children with a CI with the language development of Flemish children with a CI. The Dutch children grew up in a bilingual environment where they learned both spoken language and sign language. In principle, the Flemish children learned only spoken language. Research showed that the spoken language of the Flemish children developed more quickly than that of the Dutch children. It was also clear that once the Dutch children had a CI, their sign language skills developed no further. In addition, over the course of time the Dutch children developed a preference for spoken language.

While these results give the impression that a monolingual setting is better for the development of language than a bilingual setting, they should be interpreted with caution, as the Flemish children in the study differed from the Dutch ones in a number of other relevant areas. It is therefore possible that the developmental differences were not caused solely by the language environment but were also partially influenced by other factors. For example, the Flemish children were given far more intensive professional attention than the Dutch ones. It was also apparent that the Dutch children did not really grow up in a bilingual environment: the longer they had their CI, the more their parents communicated with them in spoken language. Sign language was then used only in the treatment group or at school. This might partly explain why the children themselves developed a preference for spoken language, and also why they made little progress in sign language.

The standard bilingual approach to children with a CI seems no longer to be justified. The languages on offer should be tailored to the abilities of the individual child. If a child has well-developed spoken language skills, it does not seem expedient to teach them sign language. However, if a child has difficulty learning spoken language, a bilingual environment would seem to be useful.

Chapter 4 compares children with a CI and hearing children with regard to aspects of emotion regulation and social functioning. The ages of the children ranged between eighteen months and five years old.

The regulation of emotion is important in social functioning, which is influenced by the ways in which we express and cope with our emotions – in a frustrating situation, for example. Children with a CI proved to be less able to regulate their emotions than hearing ones. For example, if they found themselves in a frustrating situation, hearing children were better able to focus their attention on something else. Similarly, after experiencing a negative emotion, hearing children were better able to think of ways to cheer themselves up than children with a CI were. Children with a CI were also less socially competent than their hearing peers: for example, they had more problems in interaction with other children.

A striking finding was that the relationship between emotion regulation and social competence was different in children with a CI than in hearing children. In hearing children, there was a strong relationship between proper emotion regulation and good social competence – a relationship we did not find in children with CI. This suggests that social competence develops differently in children with a CI than in hearing children. Children with a CI appear to be less aware of how to use their emotions in social interaction. The fact that they are less socially competent than hearing children can be partially explained by the fact that they have fewer language skills. While this is logical (it is important to have good language skills when associating with peers, for example), we did not find a relationship between emotion regulation and language skills. This may be explained by the fact that a number of the tasks in this study could be carried out without using language.

The results in **Chapter 5** show that children with a CI have less understanding of emotions than hearing children. The ages of the children in this study ranged from two-and-a-half to five-years old. Although children with a CI were as able as hearing children to differentiate between a drawing of a man wearing a hat and another of a man wearing glasses, they had more difficulty distinguishing between a happy face and an angry one. They were also less good at recognizing emotions in drawings of faces that were happy, angry, scared or sad. Similarly, they were less good at identifying how a child would feel in certain situations. For example, on being shown a drawing of a child looking at a large and scary dog, they were less able than hearing children to indicate how that child would feel. They were not only worse at naming the emotion (by word or sign), but also at indicating the drawing of the facial expression that showed the appropriate emotion.

This research does not clearly identify the extent to which a child's language skills are involved in understanding emotions. In hearing children we found a strong relationship between the understanding of language and all the tasks of emotion. However, in children with a CI, the relationship with understanding of language was present only in those tasks in which the children had to indicate how a child would feel in a certain situation. The fact that language skills in children with a CI do not play such a big role as in hearing children shows that the social environment, too, is important for emotional development (i.e. for emotion socialization). The delay in understanding emotions found in young children with a CI can possibly be explained by the fact that they pick up less of what is happening in their direct environment – after all, during the early part of their life they had no access to language. With regard to the understanding of emotions, it is possible that children with a CI make up the delay as they grow older. In order to gain insight into this matter, it is important to continue to follow of these children over time.

Chapter 6 sets out all the results of the study. In young children with a CI, language development and the social-emotional development are both delayed compared to their hearing peers. However, it is not yet clear how these children will develop in the future. The children who participated in this study were still very young, and a number of them received their CI relatively late. It is possible that they will catch up with hearing children when they are older and have had a longer period of access to spoken language. For this reason it is important to investigate how they fare as they grow up, and also to extend the study group by including the current generation of children who got their CI around their first birthday. Only then can it be established whether children with a CI have caught up with their peers with regard to language and social-emotional development. It will also be possible to gain more insight into the roles played by language skills and emotional competence in the social functioning of children with a CI. To date, most of the research in this field has been done in children who received their CI when they were older than the current generation of deaf children.

This chapter also makes recommendations on how the care and counseling of children with a CI can be improved. To create the best possible environment for children with a CI, every factor that influences the child's development should be taken into consideration – not just factors in the child's direct environment (such as the quality and quantity of interaction between children and their parents), but also those in wider society (such as language environment). This will make it possible to gain insight into the protective factors and risk factors that affect each individual child. Only then will it be possible to create an environment in which it is possible for every child with a CI to develop to his or her full potential.

Samenvatting

In Nederland worden jaarlijks 150 tot 200 dove kinderen geboren. Doofheid heeft grote gevolgen voor de ontwikkeling van kinderen, omdat deze kinderen geen toegang hebben tot gesproken taal. Daardoor verloopt de interactie tussen dove kinderen en hun veelal horende ouders vaak moeizaam. Een goede interactie tussen ouders en kinderen is belangrijk voor de ontwikkeling, met name de taalontwikkeling, de intellectuele ontwikkeling en de sociaal-emotionele ontwikkeling. Sinds de jaren ’90 van de vorige eeuw kunnen dove kinderen een cochleair implantaat (CI) krijgen. Een CI is een implanteerbare gehoorprothese en bestaat uit twee delen: het inwendige en het uitwendige gedeelte. Het uitwendige gedeelte bestaat uit een microfoon, die geluiden uit de omgeving opvangt, en een processor, die deze geluiden omzet in elektrische signalen. Deze signalen worden vervolgens digitaal doorgegeven aan het inwendige gedeelte, het implantaat, door de hoofdhuid heen. Het implantaat zendt de informatie naar de hoorzenuw en in de hersenen wordt het uiteindelijk waargenomen als geluid. Een CI herstelt dus niet het gehoor, maar geeft een patiënt wel de mogelijkheid om geluid te kunnen waarnemen, en zo weer te kunnen communiceren. Op dit moment krijgt ongeveer 95% van alle kinderen die doof of ernstig slechthorend geboren worden een CI.

Hoewel de effecten van een CI op de taalontwikkeling veelbelovend zijn, zijn er grote verschillen tussen individuele kinderen. De ontwikkeling van sommige kinderen met een CI wijkt nauwelijks af van horende kinderen, terwijl andere kinderen geen baat bij hun CI lijken te hebben. De vraag die zich dan voordoet is welke factoren van invloed zijn op de effecten van een CI. Van sommige factoren is bekend dat ze een positieve invloed hebben op de ontwikkeling van kinderen met een CI. Een belangrijke factor is de leeftijd waarop kinderen hun CI krijgen: als kinderen jonger zijn dan achttien maanden dan heeft dat een positief effect op de taalontwikkeling. Een andere factor die een positief effect heeft, is een hoge mate van betrokkenheid van de ouders bij het revalidatieproces. Maar van andere factoren, zoals culturele en sociale factoren, is niet duidelijk hoe ze de ontwikkeling van kinderen met een CI beïnvloeden.

De centrale vraag in dit proefschrift is hoe een CI de ontwikkeling van kinderen beïnvloedt en welke factoren een belangrijke rol spelen, waarbij het sociaal-ecologisch model van Bronfenbrenner het kader vormt. Uitgangspunt van dit model is dat de ontwikkeling van kinderen beïnvloed wordt door de kwaliteit en kwantiteit van interpersoonlijke interacties van kinderen met ouders en andere mensen in hun omgeving. Indirect worden deze interpersoonlijke interacties beïnvloed door de directe omgeving waarin kinderen leven, maar ook door de ideologische, politieke en culturele waarden in de samenleving. In dit proefschrift komen de volgende drie onderwerpen aan de orde:

1. De invloed van ouders met een Turkse achtergrond op de ontwikkeling van kinderen met een CI
2. De invloed van het gebruik van gesproken taal en gebarentaal op de ontwikkeling van kinderen met een CI
3. De invloed van een CI op het sociaal-emotioneel functioneren van kinderen.

In **hoofdstuk 1** wordt het sociaal-ecologisch model van Bronfenbrenner nader uitgewerkt aan de hand van deze drie onderwerpen.

De resultaten beschreven in **hoofdstuk 2** laten zien dat ouders met een Turkse achtergrond problemen ervaren met betrekking tot de zorg voor hun dove kind in Nederland. Een opvallende bevinding was dat veel ouders in het begin niet geloofden dat hun kind echt doof was. Zij bleken bovendien weinig vertrouwen te hebben in de Nederlandse gezondheidszorg wat blijkt uit het feit dat meer dan de helft van de geïnterviewde ouders aangaf dat ze een second opinion hadden gevraagd van een Turkse arts in Turkije. Ook bleek dat de communicatie tussen ouders met een Turkse achtergrond en hulpverleners niet altijd optimaal verliep. Als het gaat om beslissingen nemen met betrekking tot de behandeling en de zorg voor het kind lijken Turkse ouders en hulpverleners diametraal tegenover elkaar te staan. Hulpverleners in Nederland zijn gewend de ouders objectieve informatie te geven met voor- en nadelen van de verschillende opties, zodat de ouders zelf kunnen kiezen. Turkse ouders lijken hier minder of geen behoefte aan te hebben. Zij willen graag horen wat de beste oplossing is voor het probleem: de hulpverlener is immers de deskundige! De verwachtingen van de zorg kunnen dan ook hooggespannen zijn. Het doen van (voor ouders langdurig en onduidelijk) onderzoek leidt dan vaak tot teleurstelling als er geen eenduidige conclusies uitkomen. Dit zou mogelijk het verminderd vertrouwen in de Nederlandse hulpverleners kunnen verklaren. Bovenstaande heeft negatieve gevolgen voor dove kinderen met een Turkse achtergrond: deze kinderen bleken gemiddeld bijna een jaar later een CI te krijgen dan Nederlandse kinderen. Sommige Turkse ouders hadden achteraf spijt dat hun kind niet op jongere leeftijd een CI had gekregen. Zij zagen dat andere kinderen die op jongere leeftijd een CI hadden gekregen zich beter ontwikkelden dan hun kind. Om ouders te helpen bij het nemen van beslissingen rondom gehoorrevalidatie en CI zou de hulpverlening gebruik kunnen maken van de spijt die ouders achteraf hebben door op deze spijt te anticiperen. Een andere mogelijkheid is om de ouders te verwijzen naar een in Nederland werkzame arts met een Turkse achtergrond, zodat er geen kostbare tijd verloren gaat bij het vragen van een second opinion.

In **hoofdstuk 3** werd de taalontwikkeling van Nederlandse kinderen met een CI vergeleken met de taalontwikkeling van Vlaamse kinderen met een CI. De Nederlandse kinderen groeiden op in een tweetalige omgeving: zij leerden zowel gesproken taal als gebarentaal. De Vlaamse kinderen leerden in principe alleen gesproken taal. Uit het onderzoek bleek dat de gesproken taalontwikkeling van de onderzochte Vlaamse kinderen sneller verliep dan die van de Nederlandse kinderen. Opvallend was dat de gebarentaal van Nederlandse kinderen zich nauwelijks nog ontwikkelde als ze eenmaal een CI hadden. Bovendien bleken Nederlandse kinderen na verloop van tijd een voorkeur te ontwikkelen voor gesproken taal. Deze resultaten wekken de indruk dat een ééntalige omgeving beter is voor de taalontwikkeling dan een tweetalige omgeving. Deze resultaten moeten echter met enige voorzichtigheid geïnterpreteerd worden. De Vlaamse en Nederlandse kinderen in het onderzoek verschilden namelijk ook van elkaar op enkele andere relevante kenmerken. Het is dan ook goed mogelijk dat de verschillen in ontwikkeling niet alleen veroorzaakt werden door de taalomgeving, maar deels ook door andere factoren. Vlaamse kinderen werden bijvoorbeeld veel intensiever begeleid door professionals dan Nederlandse kinderen. Bovendien bleek dat de Nederlandse kinderen niet echt in een tweetalige omgeving opgroeiden. Naarmate de kinderen hun CI langer hadden, gingen ouders steeds meer in gesproken taal communiceren met hun kind. Kinderen kregen gebarentaal dan alleen nog aangeboden op de behandelgroep of op school. Dit zou een mogelijke verklaring kunnen zijn voor het feit dat de kinderen zelf een voorkeur voor gesproken taal ontwikkelden, maar ook dat ze niet vaardiger werden in gebarentaal. Standaard een tweetalig aanbod voor kinderen met een CI lijkt dan ook niet langer gerechtvaardigd. Het taalaanbod zou toegesneden moeten worden op de mogelijkheden van het individuele kind. Als een kind een goede gesproken taalontwikkeling heeft, lijkt het leren van gebarentaal niet opportuun. Als een kind echter moeite heeft met de verwerving van gesproken taal, kan een tweetalige omgeving nuttig zijn.

In **hoofdstuk 4** werden aspecten van emotieregulatie en sociaal functioneren van kinderen met een CI vergeleken met die van horende kinderen. De leeftijd van de kinderen varieerde van anderhalf tot vijf jaar. Emotieregulatie is belangrijk voor het sociale functioneren. De manier waarop we onze emoties uiten en de manier waarop we met onze emoties omgaan in bijvoorbeeld een frustrerende situatie, hebben invloed op het sociale functioneren. Kinderen met een CI bleken hun emoties minder adequaat te reguleren dan horende kinderen. Horende kinderen bleken bijvoorbeeld beter in staat om hun aandacht ergens anders op te richten als ze zich in een frustrerende situatie bevonden. Ook konden horende kinderen beter dan kinderen met een CI manieren bedenken om weer blij te worden als ze een negatieve emotie ervoeren. Bovendien waren kinderen met een CI minder sociaal competent dan hun horende leeftijdsgenootjes: zij hadden bijvoorbeeld meer problemen in contacten met andere kinderen. Een opvallende bevinding was dat de relatie tussen emotieregulatie en sociale competentie voor kinderen met een CI anders was dan voor horende kinderen. Bij horende kinderen was er een sterke relatie tussen adequate emotieregulatie en goede sociale competentie. Bij kinderen met een CI vonden we deze relatie niet. Dit kan betekenen dat sociale competentie zich bij kinderen met een CI anders ontwikkelt dan bij horende kinderen. Kinderen met een CI lijken zich minder bewust te zijn hoe zij emoties in kunnen zetten in sociale interacties. Het feit dat kinderen met een CI sociaal minder competent zijn dan horende kinderen is deels te verklaren uit het feit dat de kinderen met een CI minder taalvaardig waren dan de horende kinderen. Dat is ook wel logisch, want bijvoorbeeld in de omgang met leeftijdsgenootjes is het van belang om goede taalvaardigheden te hebben. We vonden echter geen relatie tussen emotieregulatie en taalvaardigheid. Dit kan verklaard worden uit het feit dat een aantal van de taakjes in dit onderzoek zonder taal konden worden uitgevoerd.

De resultaten in **hoofdstuk 5** lieten zien dat kinderen met een CI minder begrip hadden van emoties dan horende kinderen. De leeftijd van de kinderen in dit onderzoek varieerde van tweeënhalf tot vijf jaar. Kinderen met een CI konden wel net zo goed als horende kinderen onderscheid maken tussen een tekening van een man met een hoed en een man met een bril, maar hadden meer moeite met het onderscheid tussen bijvoorbeeld een blij gezicht en een boos gezicht. Ook waren ze minder goed in het benoemen van een emotie bij tekeningen van gezichten die blij, boos, bang of verdrietig keken. Bovendien konden ze minder goed aangeven hoe een kind zich in bepaalde situaties zou voelen. Bijvoorbeeld, als ze een tekening zagen van een kind dat een grote, enge hond ziet, konden ze niet zo goed als horende kinderen aangeven hoe dat kind zich zou voelen. Ze waren niet alleen slechter in het benoemen van de emotie (woord of gebaar), maar ook in het aanwijzen van een tekening met de bijpassende emotionele gezichtsuitdrukking.

Uit dit onderzoek werd niet duidelijk in hoeverre de taalvaardigheid van kinderen een rol speelt bij het begrijpen van emoties. Bij horende kinderen vonden we een sterke relatie tussen taalbegrip en alle emotietaakjes, maar bij kinderen met een CI was de relatie met taalbegrip alleen aanwezig bij de taakjes waarbij de kinderen moesten aangeven hoe een kind zich zou voelen in een bepaalde situatie. Het feit dat taalvaardigheid bij kinderen met een CI niet zo'n grote rol speelt als bij horende kinderen, laat zien dat ook de sociale omgeving van belang is voor de emotionele ontwikkeling, de zogenaamde emotie socialisatie. De achterstand van jonge kinderen met een CI in het begrijpen van emoties kan mogelijk verklaard worden doordat zij minder meekrijgen wat er in hun directe omgeving gebeurt. In de eerste periode van hun leven hadden zij immers nog geen toegang tot taal. Ook met betrekking tot het begrijpen van emoties is het mogelijk dat kinderen met een CI hun achterstand inlopen als zij ouder worden. Om hier inzicht in te krijgen is het belangrijk om de ontwikkeling van deze kinderen gedurende meerdere jaren te volgen.

In **hoofdstuk 6** worden alle onderzoeksresultaten nog een keer op een rijtje gezet. Zowel de taalontwikkeling als de sociaal-emotionele ontwikkeling van jonge kinderen met een CI is vertraagd in vergelijking met hun horende leeftijdsgenootjes. Het is echter nog niet duidelijk hoe deze kinderen zich in de toekomst zullen ontwikkelen. De kinderen in dit onderzoek waren nog erg jong en een deel van de kinderen kregen hun CI relatief laat. Mogelijk halen ze hun achterstand op horende kinderen in als ze ouder worden en langer toegang tot gesproken taal hebben. Daarom is het belangrijk om te onderzoeken hoe het met deze kinderen gaat als ze ouder worden, alsmede de onderzoeksgroep uit te breiden met de huidige generatie kinderen die hun CI al rond hun eerste verjaardag krijgen. Pas dan kan nagegaan worden of kinderen met een CI hun achterstand in taalontwikkeling en sociaal-emotionele ontwikkelen inhalen. Bovendien kan dan ook meer inzicht verkregen worden in welke rol taalvaardigheid en emotionele competentie spelen in het sociale functioneren van kinderen met een CI. Het meeste onderzoek dat tot nu toe gedaan is, was bij kinderen die ouder waren dan de huidige generatie dove kinderen toen zij hun CI kregen. In dit hoofdstuk worden ook aanbevelingen gedaan hoe de zorg en begeleiding van kinderen met een CI verbeterd kan worden. Om een optimale omgeving te creëren voor kinderen met een CI is het nodig om alle mogelijke factoren die van invloed zijn op de ontwikkeling van het kind in ogenschouw te nemen. Dit geldt zowel voor factoren uit de directe omgeving van de kinderen, zoals de kwaliteit en kwantiteit van de interactie tussen kinderen en hun ouders, als factoren uit de samenleving, zoals de taalomgeving. Op deze manier kan inzicht verkregen worden in beschermende factoren en risico factoren voor elk individueel kind. Pas dan kan een omgeving gecreëerd worden waarin elk kind met een CI zich optimaal kan ontwikkelen.

Curriculum Vitae

Karin Wiefferink was born on the 22th of December 1959 in Denekamp. After finishing Atheneum B at Thij College in Oldenzaal in 1978, she started the in-service training for X-ray technician at the Teaching Hospital in Utrecht. After graduating in 1980, she started to study Dutch language and literature at the University of Utrecht in 1981. She graduated in 1987 and shortly after that she started working at the X-ray department of the Teaching Hospital of the Free University in Amsterdam as an X-ray technician. In 1989 she became in-service teacher of X-ray technician students at the same department. In 1991, she started to study Educational Sciences at the University of Amsterdam, where she graduated in 1995. Her research career started in 1993 at the research center primary-secondary health care, also in the Teaching Hospital of the Free University, first as a research assistant and in 1996 as a researcher. In 1999 she became a researcher at TNO, a research institute in Leiden, where she focused on implementation research and health promotion research. In 2007 she started as senior researcher at NSDSK, the Dutch Foundation for the Deaf and Hard of Hearing Child, where she conducted the research presented in this thesis.