



The Ear Foundation®

Language and literacy skills:

performance of reading and writing of deaf children with cochlear implants



A research study funded by Ovingdean Hall Foundation and Advanced Bionics, and carried out by The Ear Foundation.

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The Ear Foundation

Hearing and communicating in a technological era



Introduction

Historically, profoundly deaf learners often left school with poor outcomes in reading and writing, which had a negative impact on educational attainments. Current government data show that deaf children continue to lag behind their hearing peers in educational attainments. However, cochlear implantation now provides profoundly deaf children with useful hearing early in life, with access to speech and language earlier and earlier. The majority are able to develop spoken language, and are showing improved literacy skills. Their writing skills however, have been rarely explored. Writing skills are important to develop to enable young people to do well in examinations, to write their CVs, to be able to write effective job applications for example.

The study

This booklet describes a study carried out by The Ear Foundation which investigated mainly the two areas of reading and writing skills, both of which influence educational attainments.

Thirty three deaf pupils aged between 9-16 years were asked to perform tasks to explore their literacy skills. They included a range of pupils and we looked at their use of their implant system(s), their language and literacy skills, and the factors which appeared to influence their progress.

Their parents were asked to fill in questionnaires on the pupils' backgrounds and use of their cochlear implant(s). The pupils came from throughout England, and the study took place in 2014.

Page 4 gives more information about the background of these pupils.

Who contributed to this booklet

This study was carried out by Sue Archbold, Connie Mayer, Linda Watson, Zheng Yen Ng and Teachers of the Deaf data collectors Angela Wootten, Catherine Healey and Tina Wakefield and advised by Gerard Bol and Imran Mulla.

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Executive summary

- With regard to the use of the cochlear implant, 81% of the group consistently wore or asked for their devices to be put on all the time. Seventy-two percent of the children could use a telephone with a known speaker (highest rating), and 88% understand a conversation without lip-reading. With regard to speech intelligibility, 85% of the children can be understood by someone who has little experience of a deaf person's speech; 67% of the children could be fully understood in everyday contexts.
- In terms of vocabulary, 75% of the sample showed scores commensurate to hearing peers (average) on receptive vocabulary. Sixty-seven percent of the participants scored in line with hearing peer norms (average) on expressive vocabulary.
- In terms of reading comprehension, 88% of the participants scored within hearing norms with 75% of the sample showing scores on a par with their hearing peers (average), and 13% considerably higher than the average scores of hearing peers (above average).
- Outcomes in writing were not as strong as those in reading, with only 44% writing at or above grade level. However it is important to note that, with one exception, the group did not show the use of the non-standard English in their writing that was typical of deaf learners in the past, and were using strategies typical of hearing children such as invented spelling, reflecting their increased access to audition. This is a significant, critical shift providing evidence that cochlear implantation is having a positive impact on writing performance.
- Factors which influenced progress were: age at implantation, the use of two cochlear implants and age at testing. Those who were better readers tended to be better writers, and poorer performance in expressive vocabulary seemed to be linked to poorer outcomes in writing.

The group of pupils

The group of pupils included twenty-six born deaf, six deafened by meningitis and one with auditory neuropathy, with 15% (5 pupils) reported as having additional needs. There were 18 boys, and 15 girls. Nineteen of the group had bilateral implants, two simultaneously and 17 sequentially. The mean age of implantation of the first CI was 3,5 yrs with a range of 1-15 years, and the age of implantation of the second CI was 7 years with a range of 1-15 years.

Twenty-three of the pupils were in mainstream schools, seven in schools for the deaf and three in resource bases attached to mainstream schools. With regard to mode of communication, currently twenty-seven students were using oral communication at home and in school, of which 52% (17 students) had switched to oral communication at home, and 30% (10 students) had switched to oral communication in school. Six students used oral communication with sign. The students were noted to have changed communication mode over time, towards increased use of spoken language.

Eighty-five percent (28 pupils) of the pupils scored average norms on a non-verbal IQ test (Test of Nonverbal Intelligence; TONI) and 15% (5 pupils) were above the mean.

See measures in Appendix.



Using the implant

Using the Meaningful Auditory Integration Scale (MAIS) 81% of the children (25 pupils) wore their implant(s) frequently to always.

Using the Categories of Auditory Performance (CAP) we found that 72% (23 pupils) could use a telephone with a known speaker (highest rating), 16% (5 pupils) could understand a conversation without lip-reading, and another 9% (3 pupils) understand common phrases without lip-reading. Only one participant (age at testing: 15;5; age of implantation: 6;6) was at the level of only being able to identify environmental sounds.

Thinking about the intelligibility of their speech, essential for effective daily communication, 85% (28 pupils) were reported able to be understood by someone who has little experience of a deaf person's speech.

Twenty two (67%) of the children could be fully understood in everyday contexts, using the Speech Intelligibility Rating, (SIR), as reported by parents.

67% of the children could be fully understood in everyday contexts



What about vocabulary?

For hearing children, vocabulary is “picked up” in everyday conversation and in overhearing conversations. For profoundly deaf children, this is more difficult, but cochlear implantation has made this more possible. This is often called incidental learning.

When we looked at the young people’s receptive vocabulary, (what they understood) 75% scored within the average range for hearing children.

Thinking about their expressive vocabulary, (the vocabulary they use with understanding) 67% of the participants scored in line with their hearing peers.

This is of significance: these young people were showing vocabulary scores higher than in the past: to be able to read at higher levels one has to be able to have developed a wide vocabulary.



How about their reading skills?

The results of the Single Word Reading Test scores showed that 76% of the participants scored within hearing norms; 55% of the participants showed scores commensurate with hearing peers (average), and 21% showed scores considerably higher than the average scores of hearing peers (above average).

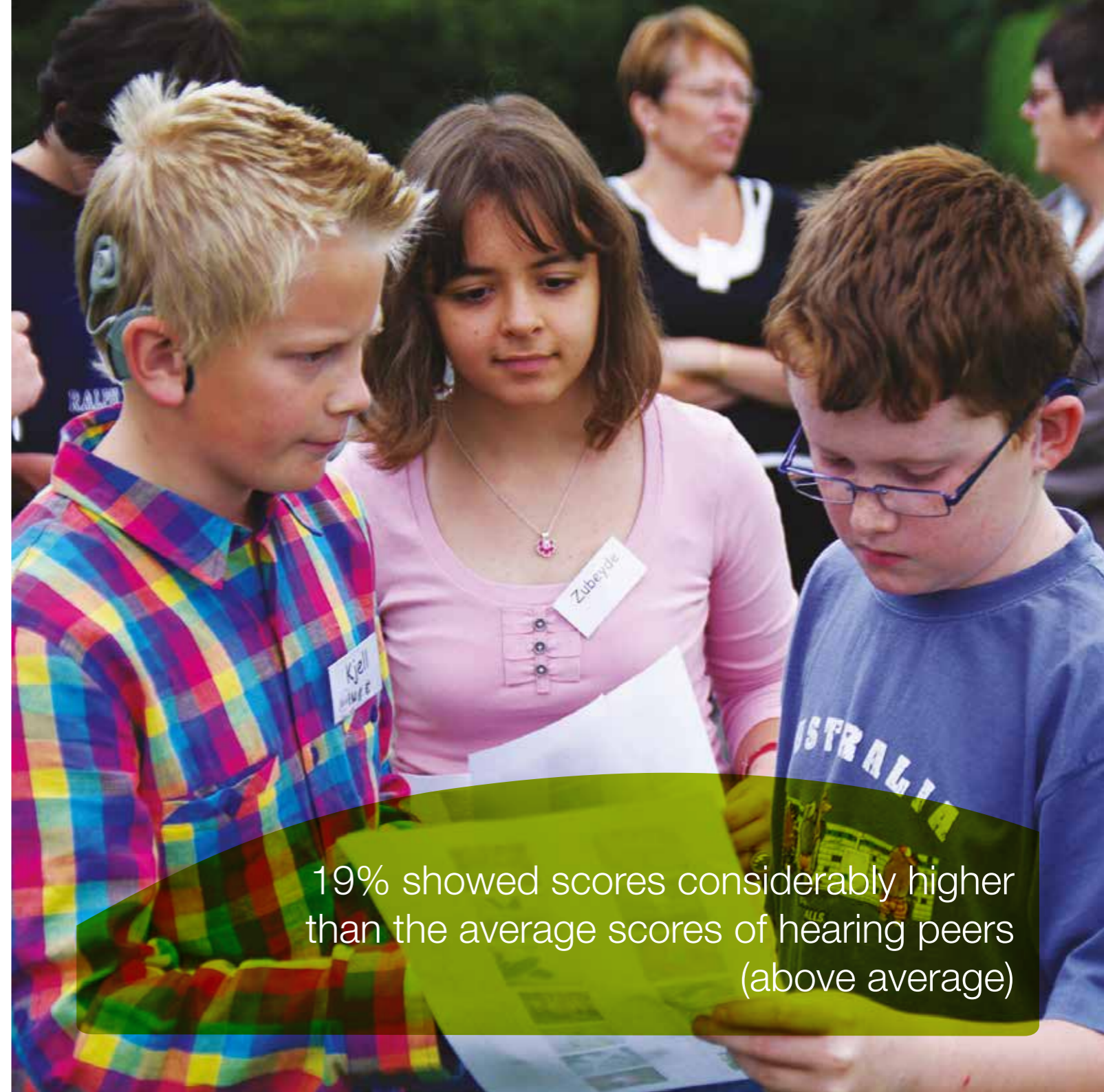
The results on reading rate (YARC) showed that 81% of the participants scored within hearing norms; 72% of the sample showed scores commensurate to hearing peers (average), and 9% showed scores considerably higher than the average scores of hearing peers (above average).

Thinking about reading comprehension (YARC), the results showed that 88% of the participants scored within hearing norms; 75% of the sample showed scores commensurate to hearing peers (average), and 13% showed scores considerably higher than the average scores of hearing peers (above average).

In addition to reading rate and reading comprehension, the YARC-Primary version also included a reading accuracy measure; participants aged between 9;0-11;11 years; 16 pupils.

The YARC-Primary-Accuracy measure showed that 75% of the participants scored within hearing norms; 56% of the sample showed scores commensurate to hearing peers (average), while 19% showed scores considerably higher than the average scores of hearing peers (above average).

19% showed scores considerably higher than the average scores of hearing peers (above average)



How are their writing skills?

Using ratings from the English National Curriculum guidelines, 25% of the participants scored at grade level, and 19% above their grade level expectations in writing. The remaining 56% scored below grade level - a result that stands in marked contrast to performance in reading comprehension where 76% were at or above grade level. Writing samples from three 9-year-old children are shown in Figures 1, 2 and 3 to illustrate the range of performance at this age level, and to highlight relative strengths and areas for growth. Figure 4 provides an illustration of an average written sample from a thirteen year old.

In all three samples the children consistently use standard English grammar and syntax including a high number of complex and compound-complex sentences. This observation is further reinforced by the fact that the mean length of utterance is greater than 13 words in all three cases, indicating the use of more complex language. All three writers made use of invented spelling in the same way that hearing writers do (e.g., sistam for system, reely for really, intill for until). This reflects the access to the phonology of English they hear through their implants.

This is very different from the writing of profoundly deaf children in the past, most of whom did not use invented spelling, and typically used non-standard English syntax and grammar with an overreliance on simple sentence patterns and formulaic structures.

While the writing in all three samples is clear and easy to understand, the children did not use a wide and varied vocabulary (e.g., few adjectives and adverbs), perhaps mirroring the relatively weaker performance in expressive versus receptive vocabulary (TOWK). Text structure tended to be simple lacking supporting details and information, and clear opening and closing statements - features that are often identified as areas of growth for hearing writers as well.

Examples

My name is H..... and when I went to the bach and my bðdad hung me upsid bane and I lost my in plandt so I did not hear. ~~of anuker yare year~~ when im go swimming I ware ear bags so I can hir in the pool. I have somme colus I neely war them evry day.

Figure 1. Example of writing sample (9;2 years)

Once last year I went to a disco were there was music, sweets and dancing. It was so fun intill one outhr other student stealed my implant and went of to hide. because it was so dark I did not know who it was. we only know whoever it was he or she was in key stage one and likes sweets and tatoes. lucky We found the implant but not the person who took it. I can guess we will find out who it was soon.

Figure 2. Example of writing sample (9;2 years)

My first imptant sounds louder hð I op got my first one when I was 1½ and my second one at nearly 5. My implants are very useful because if I didn't have them I wouldn't be able to hear or do much maybe not even speepk. When I go to bed I take my implant off so I can sleep. When I go to a club I use a micerphone called an FM sistam and it goes streat to my implant so I can hear. For my FM sistam I have something that plugs into my is implant. also you can plug it into a T.V.

Figure 3. Example of writing sample (9;9 years)

My cochlear implants give me a connection to the world and help me hear sounds, voices, the world in general. They also give me a conversation starter and give me more people to make friends with. For example, there are lots of people who I wouldn't have a friendship with, if it wasn't for my implants: one has a deaf brother, one is deaf and one has two deaf twin sisters. I wouldn't knew these people if it wasn't for my implants. They do . occassionly, bring up questions but I am more than happy to answer them. I rarely get stopped in the street or in supermarkets for because of them. They really aren't that noticeable. even at school when I have my hair tied back. Lots of people don't even realise my implants exist. even after they talk to me in person. One person was friends with me for four months before it came up in conversation. then they were shocked to learn that I was deaf. There are colour and sticker choices, to make them less inconpicuous. I choose not to use these, simply because they seem far too bright. ~~Who even decer~~ Hearing people don't colour their ears. Why should a deaf person colour in theirs? I don't understand why some deaf people feel the need to hide their implants, some are even ashamed of them! Why? It might make you different but we don't live in the Dark Ages! You won't be hanged or burned for being deaf. Some wear hoods up or keep their hair loose. One person I knew would even take them off when she was in public eye!

Figure 4. Example of writing sample (13;8 years)

What factors supported progress?

The results showed relationships between age of implantation, age at testing, number of cochlear implants in comparison with a number of the measures. Reading comprehension and writing skills also showed a relationship: better readers were better writers.

Age of implantation

- The age of implantation showed a relationship with reading comprehension. The earlier the child is implanted, the higher than average scores on reading comprehension seem to be.
- In addition, the age of implantation showed a relationship with the writing skills. The earlier the child is implanted, the better the writing samples seem to be.
- Furthermore, two groups were identified according to age of implantation: children implanted before 24 months (n = 10) and children implanted after 24 months (n = 20). Children implanted before 24 months had higher scores than the children implanted after 24 months on reading comprehension.

Age at testing

- The age at testing showed a relationship with expressive vocabulary. The younger the age at testing, the scores on expressive vocabulary seem to be higher.
- Furthermore, the age at testing showed a relationship with receptive vocabulary. The younger the age at testing, the higher the scores on receptive vocabulary.
- Moreover, the age at testing showed a relationship with single word reading. The younger the age at testing, the higher the scores on expressive vocabulary seem to be.
- The age at testing showed a relationship with writing skills. The younger the age at testing, the higher the scores on the writing samples seem to be.
- Furthermore, two groups were made according to the age at testing: 9-11 year olds (n = 17) and 12-16 year olds (n = 16). There was a difference found between the groups on expressive vocabulary, in favor of the 9-11 year olds who showed higher scores. Moreover, the 9-11 year olds showed higher scores on writing than 12-16 year olds.

One or two implants

- Furthermore, the number of CIs showed a relationship with expressive vocabulary. When wearing two implants, the higher the scores on expressive vocabulary seem to be.
- In addition, the number of CIs showed a relationship with the writing skills. When wearing two cochlear implants, the better the writing performance seem to be.

Reading and writing skills

- In addition, reading comprehension showed a relationship with the writing skills. The higher the scores on reading comprehension, the better the writing performance seems to be.

Table 1.

Relationships between age of implantation, age at testing and number of CIs against the vocabulary, reading and writing measures.

	Expressive vocabulary (TOWK)	Receptive vocabulary (TOWK)	Single word reading (SWRT)	Reading comprehension (YARC)	Writing samples – performance bands
Age of implantation				✓	✓
Age at testing	✓	✓	✓		✓
Number of CIs	✓				✓

Discussion & summary

The results of this study showed that for this group of deaf young people with cochlear implants, their literacy attainments are very different from those found before the introduction of cochlear implantation.

There is still often discussion as to whether deaf children should be compared with their hearing peers, and in this study they are throughout. While the group may not be entirely representative of this particularly heterogeneous group of deaf young people, they show levels of attainment not previously seen, both in literacy and in receptive and expressive English vocabulary when compared with their hearing peers. This group were implanted later than is now the average, and most implanted initially with only one implant. There is therefore reason to believe that these results may be conservative, if we were able to compare them with those being implanted today.

There is a marked difference between their attainments in reading and in writing: which is comparable to receptive and expressive communication. However, even when not writing at grade level these young people are not writing as deaf young people did in the past, and are showing some of the same features of development as hearing children, for example, invented spelling.

Our writing outcomes are based on only one sample from each young person on the same topic: for robust conclusions to be drawn, more samples, in a range of genres, are required on which to further analyse the issues we identified. With the challenges we see in written skills for these children, further work is required on a larger group of children to focus on the challenges they are finding, and to define the strategies needed to close the gap between them and their hearing peers in writing.

In summary, this group of profoundly deaf children was, on the whole, attending mainstream schools, using spoken language, showing higher vocabulary and reading and writing scores than seen in the past. However, using the English National Curriculum levels, (2013), their written work was not as strong as their reading, but they were not showing the same features as profoundly deaf children in the past.

Overall, this study illustrates a significant positive shift in language and literacy outcomes for deaf children with cochlear implants and provides evidence that the written skills of these children needs further in-depth research and the development of appropriate teaching strategies.

Appendix and further reading & references

Appendix A

Assessment protocol: assessments, measure and the person to complete the assessment.

Assessment	Measure	Completed by
Background questionnaire	Demographic characteristics	Parent
Categories of Auditory Performance (CAP)	Auditory perception	Parent
Meaningful Auditory Integration Scale (MAIS)	Adaptation to the device	Parent
Speech Intelligibility Rating (SIR)	Speech production	Data collector
Test of Nonverbal Intelligence (TONI)	Nonverbal intelligence	Data collector with young person
Test of Word Knowledge (TOWK)	Expressive and receptive vocabulary	Data collector with young person
York Assessment of Reading Comprehension (YARC) - Primary and Secondary version	Reading accuracy, reading rate and reading comprehension	Data collector with young person
Writing sample: "Me and My Implant"	Writing skills	Data collector with young person

Appendix B

Questionnaire completed by parents

Child's Details			
Child's Name:		ID:	
Sex:	Male	Female	
Address:			
Post Code:			
Date of Birth:			
Family's Details			
Mother's Name:			
Father's Name:			
Telephone Number:			
Email:			
Number of Siblings:			
Place in Family (i.e. first, second, third, fourth born):			
What is your home language?:			
Child's History (please indicate N/A where applicable)			
Does your child have any special educational needs other than hearing impairment?			
Does your child wear glasses?			
Cause of Hearing Loss:			
Age at Identification:			
Age your child received his/her hearing aid(s):			
One Aid		Two Aids	
Type of Aid(s)			
Age your child received his/her Cochlear Implant(s):			
1st CI		2nd CI	
CI Make/Model			
How does your child communicate? (Orally, Speech & Sign, Sign, Gesture)			
Now		Previously	
Does your child go to:			
a) Mainstream School b) Resource Base c) Special School			
What is the communication mode in school? (Oral, Total Communication, Sign Bilingualism, Sign & Speech)			
Now		Previously	
Notes:			

Further reading

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