What can we expect from the new generation of children with Hearing Impairment (HI)?

– Listening and spoken language level of children with HI

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Introduction

The introduction of universal neonatal hearing screening (UNHS), digital hearing aids (HA) and cochlear implants (CI) for pediatric populations with hearing impairment (HI) has improved life conditions for children with congenital HI. It has been documented that early intervention with fitting of HA by 3 months, and enrolment in family centred auditory verbal intervention by 6 months allow children to close the language gap and develop age equivalent language before they start school (1,2). But what happens with this "new generation" of children with HI when they meet more complex auditory, linguistic and academic demands in school - can they keep up with their normal hearing peers?

The present study is part of a larger project "IHEAR – in school with hearing impairment" with the overall vision: No child with HI left behind. This vision is understood in broad terms, and incorporates areas of audition/listening, speech, language, cognition and social well-being. The research unit of Decibel is the principal investigator of the project and works in partnerships with Oticon/ Oticon Medical, Rigshospitalet, University Hospital of Aarhus and Capital Region of Copenhagen.

Aims

The aim of the present study is to investigate the listening and spoken language level of children with HI in their first years of school and to identify differences and similarities between children with HA/CI.

Methods

The IHEAR project design is prospective, longitudinal and comparative, and is conducted from January 2017 to December 2020. The project includes annual testing of language, verbal working memory and functional hearing in noise. The present study investigates results from year two i.e. the first follow up testing conducted in the second half of 2018 and first half of 2019.

Tests comprise

- speech discrimination test in noise (Dantale II – a Danish matrix-test (3))
- receptive vocabulary (PPVT-4(4))
- core language, expressive language, working memory and pragmatics (CELF-4(5)).

Forty-six 5- to 9-year old children with HA or CI participates in the study. Children with HI received early identification, early treatment and intensive auditory verbal (re)habilitation. Results from Dantale II and PPVT-4 are compared with results from an age matched control group with children with normal hearing (NH) and results from CELF-4 are compared with normative data from children with NH.

Table 1. Characteristics of participants

Characteristics	Total population with HI	Children with HA	Children with CI	Children with NH
N	46 (100%)	14 (100%)	32 (100%)	122 (100%)
Gender				
Girl	18 (39%)	2 (14%)	16 (50%)	67 (55%)
Boy	28 (61%)	12 (86%)	16 (50%)	55 (45%)
Additional disabilities				
Yes	8 (17%)	1 (7%)	7 (22%)	-
No	38 (83%)	13 (93%)	25 (78%)	-
Median age of implant / HA (mths)	12	15	12	-
Mean age of implant (yrs)				
PPVT-4	7,7	7,5	7,8	7,8
CELF 4	7,9	7,5	7,10	-
Dantale II	7,6	7,5	7,7	7,4

Results

Preliminary results indicate that children with HI perform on level with, or better than children with NH on tests of receptive vocabulary, core language, expressive language and pragmatics.
Children with HA outperform children with CI and are comparable to children with NH on working memory scores. However, compared to their results on core language and expressive language it seems that working memory is a relative challenge to both groups of children with HI.
Children with HA outperform children with CI and are comparable to children with NH on speech in noise discrimination scores.

Figure 1. Dantale II

Preliminary Results – median SRT at year 2

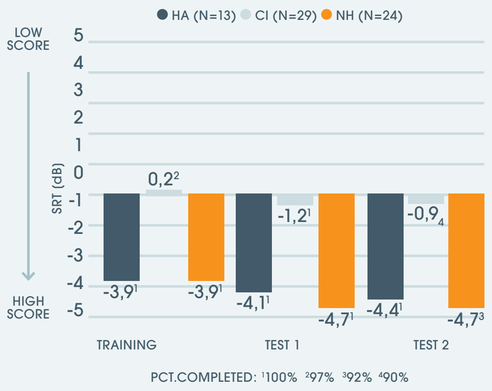


Figure 2. PPVT-4

Preliminary Results – median standard score at year 2

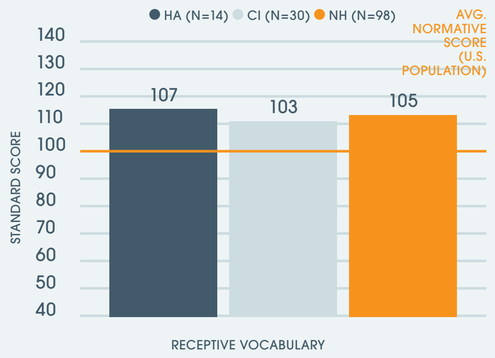


Figure 3. CELF 4

Preliminary Results – median index score at year 2

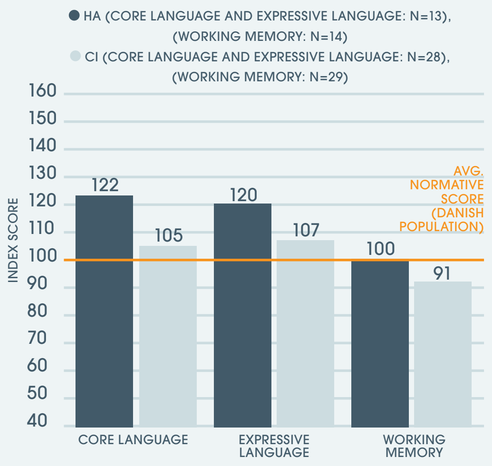
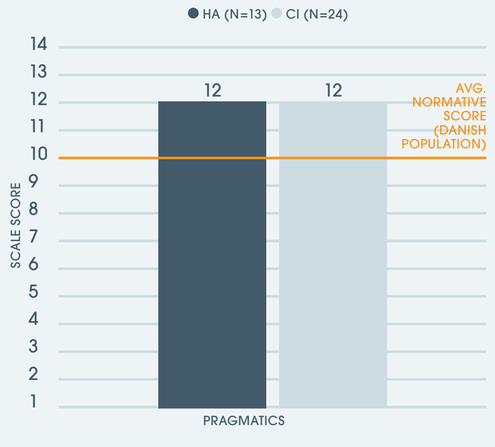


Figure 4. CELF 4

Preliminary Results – median scale at year 2



Conclusion

Our study derives knowledge about the listening and spoken language level of school aged children with HI, who received early identification, early treatment and intensive auditory verbal (re)habilitation. The preliminary results indicate a promising and bright future for the new generation of children with HI.

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