ONE-YEAR FOLLOW-UP RESULTS OF YOUNG CHILDREN SWITCHED-ON WITH HIRES 120™

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Abstract

Background: The HiRes 120™ sound coding strategy from Advanced Bionics™ implements virtual channels by steering current between two adjacent electrodes. In this way the number of stimulation sites is no longer limited to 16, the same as the number of electrode contacts but may be extended to 120 locations which correspond to 120 spectral bands. The aim of this project was to evaluate the benefit of the HiRes 120 sound coding strategy for speech production, perception and music development over a 24 month period in children.

Materials and Methods: Children between twelve months and four years of age are included in the evaluation. All subjects are first fitted with HiRes 120 using either their Harmony™ or Platinum Sound™ processors. Pre-implantation, baseline is evaluated using the Children's Implant Profile (Nottingham Version) and a free field audiogram if available. The children are evaluated with a series of questionnaires: MUSS, (IT)MAIS, SIR, CAP, PRISE and a Musical Stages Profile at approximately 3, 6, 9, 12, 18 and 24 months. Performance data using the clinic's routine tests are collected.

Results: 40 subjects from 8 centres were included in the survey. The data obtained so far up to 12 months showed a clear increase of the scores from session to session for all the questionnaires. In addition, most children were within the normal hearing range for the (IT)MAIS and PRISE questionnaires.

Conclusions: Data collection is ongoing; the first outcomes are very promising in terms of acceptance and performance with HiRes 120.

Background

The HiRes 120™ sound coding strategy from Advanced Bionics™ implements virtual channels by steering current between two adjacent electrodes. Therefore, the spectral resolution increases from 16 to 120 stimulation sites. The HiRes 120 strategy provides a more precise representation of the sound based on its increased spectral and temporal resolution [1].

Excellent results with HiRes 120 over standard HiRes were shown in a multicentre study in adults [2] regarding clarity of speech, pleasantness, quality and noise interference. In children two pilot studies [3,4] were conducted: HiRes 120 was easily managed at first fitting and immediately accepted. Questionnaires and tests in both studies showed good results in performance with the new strategy. More long term data are needed to confirm these findings in children.

The aim of the evaluation was to verify the performance of the HiRes 120 strategy in children in terms of the ability to fit HiRes 120 easily at first fitting, the benefit of HiRes 120 for speech production, perception and music development and psycho-physical fitting parameters. This is monitored over a 24-month period.

Materials and Methods

Children with profound bilateral cochlear hearing loss were included in the evaluation. They were between seven months and five years of age with no additional difficulties. They were wearing either the behind the ear Harmony™ processor or the body worn Platinum™ Sound Processor.

The assessment was based on structured parental interviews through questionnaires at different routinely scheduled follow-up sessions: at approximately 3, 6, 9, 12, 18

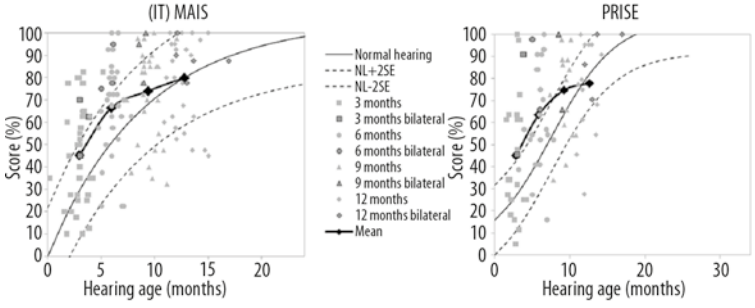

Figure 1. Graphs representing (IT)MAIS scores (left) and PRISE scores (right) for NH children and children using HiRes 120 for 3, 6, 9 and 12 months of use, in function of the hearing age.

and 24 months. All subjects were first fitted with HiRes 120. Pre-implantation baseline was evaluated using the Children's Implant Profile (Nottingham Version) [5] and a free field audiogram if available. Then speech perception was assessed through the MAIS or IT-MAIS (Meaningful Auditory Integration Scale) questionnaires [6,7] and speech test (depending on age) [8], speech production with the MUSS (Meaningful Use of Speech Scale) [9], the PRISE (Production Infant Scale Evaluation) [10] and the SIR (Speech Intelligibility Rating) [11], music development with the MSP (Musical Stages Profile) [12], and performance with the CAP (Categories of Auditory Performance) [13] and an audiogram.

The parents of each subject participating in the study gave their written consent for their child to participate in the study by signing a data release form.

A statistical analysis was performed using an unpaired sample two-tail Student's t-test to compare two groups of children depending on the age of implantation.

Results

A total of 40 subjects were included in the present evaluation. They came from 8 centres across Poland, Spain, Germany, Russia, India and Israel. The mean age at implantation was 31 months. Results up to one year follow up are included in this paper.

Figure 1 shows the comparison between HiRes 120 and Normal Hearing (NH) groups for two questionnaires: the (IT)MAIS [14] and the PRISE [15]. The (IT)MAIS provides feedback on how children react on everyday environmental sounds while the PRISE collects feedback on the pre-lexical vocalizations and auditory skills.

Data for 3 (square), 6 (circle), 9 (triangle) and 12 months (diamond) of HiRes 120 use are plotted on the NH graphs in function of the hearing age for both questionnaires. The hearing age is the duration of implant use. Most children are within or above the norms for all sessions. A few children are below the normal range but a progress in development from the 3-month session to the 12-month session can be observed.

These graphs show an improvement for all children during the first year of HiRes 120 use, which is also observed in the other questionnaires such as the Musical Stages Profile, MUSS, CAP and SIR. We then analyzed this evolution depending on age at implantation: children implanted before

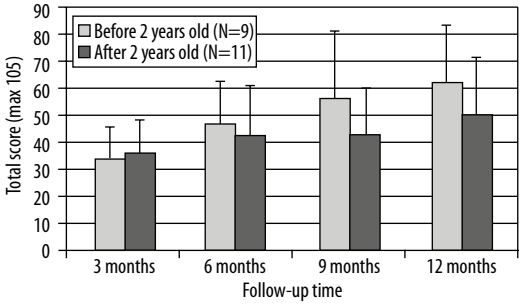

Figure 2. Graph representing the evolution of children implanted before and after two years old based on the Musical Stages Profile.

or after the age of two. Figure 2 represents this evolution for the musical development plotting the total score ("Melody and dynamics changes", "Rhythmical changes" and "Emotional aspects" sections) obtained from the Musical Stages Profile for each session and each group of children.

There is no statistical difference at this stage but children implanted earlier tend to progress faster than those implanted after the age of two years and tend to perform better after one year of device use. This tendency is also observed in most of the other questionnaire results.

Discussion

The data collection is ongoing and additional long term data are needed to confirm these outcomes. However the above results show that the HiRes 120 strategy was well accepted by children and provided a consistent progress in performance over time. These children developed abilities at a similar rate as the normal hearing children over time until one year of use: the (IT)MAIS and PRISE results were within the NH range. HiRes 120 has now become part of the standard clinical routine in a numerous number of centres (for example in Robert Debré, Paris [16]). The tendency obtained so far confirmed previous studies results showing benefits with earlier implantation [17–19]. Further analysis will also allow comparison with NH in terms of musical development.

Conclusions

The one-year results of the HiRes 120 paediatric evaluation showed that HiRes 120 was well accepted. Children fitted with HiRes 120 showed a similar speech perception/production development as normal hearing children. Data

collection will continue until the children have reached two years of implant use.

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