

HIGH-FREQUENCY DEAFNESS AND THE HYBRID COCHLEAR IMPLANT IN CHILDREN

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Abstract

High-frequency deafness in children requires different surgical approaches in order to preserve the intracochlear structure for future therapies. This investigation proved that the residual hearing could be preserved and that the auditory development of the younger children is comparable to the profound deaf children with conventional CI implanted children.

Background

Fitting hearing aids in patients with high-frequency deafness is not effective for pathophysiological reasons. The introduction of atraumatic electrodes and atraumatic surgical techniques makes it possible to protect intracochlear structures [1]. This has been evaluated by the audiological results of Hybrid-L recipients [2]. The use of an acoustic component on the ipsilateral side of the Hybrid-L implant provides the additional benefit of electro-acoustical stimulation.

Material and methods

18 children (16 unilat., 2 bilat.) with high-frequency deafness were implanted with Hybrid-L. The residual hearing was confirmed by objective measurements or if possible pure tone air conduction thresholds before surgery. The mean age of this group was 9.1 years (range 4.3–17.8 years). 10 of those children use electro-acoustic stimulation. The postoperative hearing performance and hearing preservation has been evaluated in a retrospective analysis of pure tone air conduction thresholds, aided thresholds with warble tones and if possible, speech intelligibility tests.

Results

The residual hearing could be preserved in 95% of the cases as seen in Figure 1.

Also the long term hearing preservation could be confirmed in 95% of the cases after 12 months. The aided thresholds with electro-acoustical stimulation after 6 months are visible in Figure 2.

Speech understanding in noise (S0N0) could be improved especially in the older children with electro-acoustical stimulation. The % correct values are displayed in Figure 3.

The auditory development of the younger children is comparable to the profound deaf children with conventional CI implanted children.

Discussion

Due to the high degree of hearing preservation as stated in Figure 1, children should be implanted as early as possible starting from 6 months of age. Prerequisite the intracochlear structure should be preserved by using atraumatic

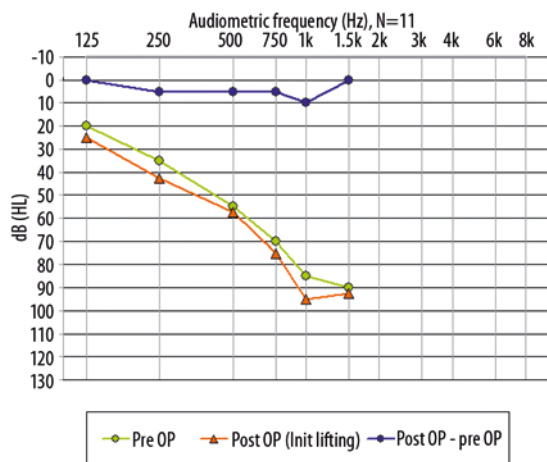


Figure 1. Median pure tone air conduction thresholds pre and post surgery.

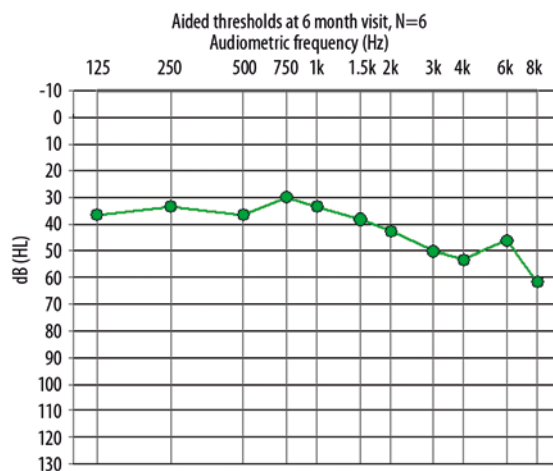
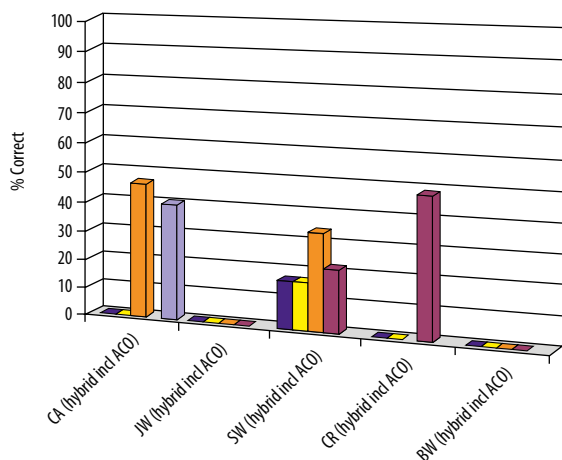


Figure 2. Average aided thresholds with ipsilateral electro-acoustical stimulation.



	CA (hybrid incl ACO)	JW (hybrid incl ACO)	SW (hybrid incl ACO)	CR (hybrid incl ACO)	BW (hybrid incl ACO)
Hybrid only (Init Fit)	0	0	16	0	0
Hybrid + ACO ipsi (3 months)	0	0	16	0	0
Hybrid + ACO ipsi (6 months)	45.8	0	33.01		0
Hybrid + ACO ipsi (12 months)		0	21.61	48.11	0
Hybrid + ACO ipsi (2 years)	39.6				

Figure 3. Speech intelligibility score in noise.

electrodes, like Hybrid-L combined with atraumatic surgery. The additional benefit of applying electro-acoustic stimulation should be used also in children to provide frequency independent aided thresholds for a sufficient speech performance development as seen in Figures 2 and 3. Since the auditory development in children with electro-acoustical stimulation is comparable to profound deaf children with conventional CI, the electro-acoustical stimulation followed by atraumatic surgery with atraumatic electrodes should be considered for profound deaf children.

Conclusions

The method of atraumatic implantation and electro-acoustic stimulation extends the conventional indication for Cochlear Implantation and opens the perspective to future technologies, e.g. hair cell regeneration. Since there is no impact, rather an advantage, of applying electro-acoustic stimulation also in very young children, atraumatic surgery with Hybrid-L should be considered for profound deaf children.

References:

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2. Buechner A, Schuessler M, Battmer RD et al: Impact of Low-Frequency Hearing. *Audiol Neurotol*, 2009;14 (Suppl.1): 8–13