

Abstract EFAS/DGA 2007

Acoustical frequency discrimination and speech perception in noise in EAS implanted ears

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Objectives:

The results of a recently published study with speech in noise stimuli delivered to a model with simulated cochlear implant speech processing and presented to normal hearing ears have shown, that the addition of low-frequency pitch cues can remarkably improve speech recognition in noise (Chang et al., 2006). A brain-based mechanism is assumed that uses the voice pitch cue in the low-frequency sound to first segregate the target voice from the competing voice and then to group appropriate temporal envelope cues in the target voice for robust speech recognition under realistic listening situations. It is presumed, that this mechanism is responsible for the highly synergistic effects seen in combined electric and acoustic stimulation (EAS, Gstöttner et al., 2006). Therefore, a degradation of speech in noise performance of EAS-implantees has to be expected if the mapping of small frequency deviations is damaged.

Methods:

Frequency discrimination of implantees using combined electric and acoustic stimulation (EAS) was assessed by means of an adaptive procedure with a two-interval forced choice paradigm. The ears contra-lateral to the implanted side as well as ears of non-implanted patients with severe high frequency sloping hearing loss were tested additionally to collect reference data. EAS patients and candidates with sensorineural hearing loss (SNHL) were recruited from the clinical program. EAS patients received either the MED-EL standard electrode or the recently introduced FLEX design with reduced diameter. Speech perception in noise was tested by means of the HSM sentence test (Schmidt et al., 1997).

Results: JNDF ranged from close to normal to grossly abnormal in either the EAS or the SNHL listeners. The median JNDF was 7.1% in the SNHL and 7.5% in the EAS group. There was no statistically significant difference in terms of JNDF between both groups of listeners. Currently, the so far obtained results show no correlation between speech perception in noise and JNDF.

Conclusion: Preliminary findings demonstrate that the insertion of an intra-cochlear electrode does not significantly hamper the average frequency discrimination ability in EAS patients.

Literatur:

Chang, J.E., Bai, J.Y., Zeng, F.G. (2006) Unintelligible low-frequency sound enhances simulated cochlear-implant speech recognition in noise. *IEEE Trans. Biomed. Eng.* 53:2598-2601

Gstöttner, W., Helbig, S., Maier, N., Kiefer, J., Radeloff, A., Adunka, O. (2006) Ipsilateral electric acoustic stimulation of the auditory system: results of long-term hearing preservation. *Audiol. Neurootol.* 11:49-56

Schmidt, M., Hochmair-Desoyer, I., Schulz, E., Moser, L. (1997) Der HSM-Satztest. In: Wille, P. (ed) *Fortschritte der Akustik - DAGA '97*, Oldenburg, DEGA e.V., pp 93-94

