MASKING RELEASE WITH CHANGING FUNDAMENTAL FREQUENCY:

ELECTRIC ACOUSTIC STIMULATION RESEMBLES NORMAL HEARING SUBJECTS

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Introduction

Speech performance in noise → enormous challenge → why?

→ lack of frequency resolution in CI users

**Fundamental frequency - F0**

- important information for speech recognition
- defines pitch of the voice
  - men’s F0: ≈ 80-180 Hz
  - women’s F0: ≈ 165-255 Hz

→ representation within low-frequency region
Synergistic effects of combining electric acoustic stimulation with acoustic hearing

-> low frequency residual hearing
Informational and energetic masking effects in the perception of two simultaneous talkers

Normal hearing listeners show improved performance with different talkers
Aim of the study

• Why is EAS performance in noise superior to CI performance?

• Is there a masking release in EAS patients?
  - by increasing the F0 between target and masker signal?
Study participants

EAS (n=9)  
- ≥12 months' experience with the implant  
- MED-EL Duet2, Medium or Flex\textsuperscript{EAS} electrode  
- ≥10 active channels

CI (n=10)  
- ≥12 months' experience with the implant  
- MED-EL Opus2  
- ≥10 active channels

NH (n=10)  
- <25 dB hearing threshold between 125 and 8000 Hz
Listening configuration - EAS

- **EAS**
  - ipsilateral: EAS
  - contralateral: ear canal plugged

- **electric only**
  - ipsilateral: CI only
  - ipsi- and contralateral: ear canal plugged

- **CI**
  - ipsilateral: CI

- **NH**
  - bilateral
Material and methods – test material

Oldenburg sentence test

- German matrix sentence test

- Sentences consist of randomly selected words including names, verbs, numbers, adjectives, nouns

- Masker sentence („Thomas bekommt 18 teure Autos“)

- Target sentences (of the remaining words of the test corpus)
Test material – test procedure

Masking sentence
-F0: upward shift of 4, 8 and 12 semitones (PRAAT speech manipulation and analysis software)
-Level was adjusted adaptively according to a staircase procedure to determine the SRT (speech reception threshold)
-Signal-to-noise ratio which corresponds to 50% words correct

Target sentence
-F0 of the target was not modified
-Presented at fixed levels (65dB CI/EAS, 55dB NH)
Material and methods - sentences

semi0  semi4  semi8  semi12

target + masking sentence (semi8)
$S_0N_0$
Results – electric stimulation

CI

EAS – electric only

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Results – electric acoustic stimulation

NH

EAS

ΔF0 (semitones)

ΔF0 (semitones)

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Summary

- EAS listeners: release from masking when F0 differs!

- CI listeners: NO release from masking

- F0 within the residual low-frequency hearing is necessary to improve speech perception in competing listening situations