NYU School of Medicine

WHAT CUES DO EARLY IMPLANTED AND POST-LINGUALLY DEAFENED COCHLEAR IMPLANT USERS USE TO UNDERSTAND SPEECH?
Children are not little adults

**Early implanted children (C-Pre)**
- Develop auditory systems in response to electric input
- Never experience rich acoustic input

**Post-lingually deafened adult CI users (A-Post)**
- Develop auditory systems in response to rich acoustic input
- Adapt to electric stimulation at an older age.

Although they receive similar CI treatments, the auditory systems are likely to respond to stimulation differently.
Which population does better with an implant?

A-Post
Post-lingually deafened adult CI users
(18-65 years)

A-Pre
Adults implanted before 3 years
(17+ years)

Retrospective data from NYU Clinic

Sentences In Noise
(AzBio +10 dB % Correct)
Do kids with CIs process basic auditory information differently?
We examined differences in spectral abilities between A-Post and C-Pre populations
Spectral-temporally Modulated Ripple Test (SMRT) provides an estimate of spectral ability

- Spectrally-rippled stimuli
- The phase drifts at 5 Hz
- 3-Interval Forced-Choice
- Discriminate 20 Ripples Per Octave from a lower number of Ripples Per Octave
- 1 up/1 down rule

The SMRT is available for free at https://www.ear-lab.org/smrt.html
SMRT Correlates with Speech (for post-lingually deafened adults)

Holden et al. (2016)

Lawler et al. (2017)
• Early implanted pre-lingual children (C-Pre) have poorer SMRT scores than post-lingually deafened adults (A-Post)
• Based on correlation, one would predict that early implanted children would have poor speech scores
• But C-Pre scores may actually be better than A-Post scores!
• Maybe early implanted children are less reliant on spectral information than post-lingual adults!
Gifford et al. (2018) found no relationship between speech and spectral resolution for children with implants.

This is more evidence that kids (C-Pre) are not relying on spectral information to the same extent as post-lingually deafened adults (A-Post)
Maybe kids with CIs depend more on temporal information?
Temporal Task: Modulation Detection

Question: What is the minimum modulation depth detectable?

Tested with 3IFC adaptive track

Note: Used 100 Hz AM and not 10 Hz AM.
Temporal Task: Modulation Detection

Pre-lingually Implanted Children (C-Pre) are better than Post-lingually deafened adult CI users (A-Post) in this temporal task (Landsberger et al., 2019).
Summary

Early implanted children (C-Pre)

• Have different auditory processing abilities than post-lingually deafened adults (A-Post)
• Perform well with speech recognition
• Have poorer spectral resolution than post-lingually deafened adults (A-Post)
• Speech recognition seems to be less dependent on spectral cues than for post-lingually deafened adults (A-Post)
• May have better temporal abilities than post-lingually deafened adults (A-Post)
• May depend more on temporal cues than spectral cues for speech understanding relative to the A-Post population
Thank You!

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