Benefits of Combined Stimulation for Speech Perception in Quiet and Noise

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Work supported by NIDCD
Speech Recognition in Backgrounds
Sorted by PTA and device

SRT in dB

Group

Normal 15-25 dB 26-40 dB 41-60 dB 60-80 dB 81-100 dB Hybrid Long

Noise
Competing Talkers
4 mm vs 17 mm distance along cochlea

Hybrid-S8 cochlear implant  (short-electrode)

Nucleus-22 traditional cochlear implant  (long-electrode)

Diagrams provided by Cochlear
Information Transmitted (per mm) for long vs short electrode patients
Two Hypotheses – Why are scores getting better since 2005?

• 1. Peripheral - Better peripheral resolution in newest populations of patients (both Hybrid and Longs) – two populations will overlap

• 2. Central – Hybrid patients have zero duration of “deafness” – Hybrids will have different resolution than Long Electrodes
The more “ripples per octave a patient can discriminate, the better their peripheral resolution.
Spectral Ripples Predict Speech Scores
Henry, Turner, Behrens (2005)
Looks like peripheral resolution determines speech recognition. Hybrids can do exceptionally well on this, despite much shorter electrode.
FIG. 2. Recognition of 14 medial consonants in an a/C/a context as a function of the number of spectral channels for normal-hearing listeners (dashed line with small filled symbols) or as a function of the number of electrodes used with Nucleus-22 cochlear implant listeners (filled symbols) and Clarion cochlear implant listeners (open symbols). The hatched area plots the range of performance across all 19 cochlear implant listeners. From left to right the panels present consonant recognition as a function of decreasing signal-to-noise ratio.
Short electrode equals long-electrode even though active electrodes are more closely spaced.