# 1428: EFFECT OF PULSE RATE ON SPEECH PERCEPTION AND TEMPORAL PROCESSING OF COCHLEAR IMPLANT USERS

**Mahan Azadpour, Nicole H. Capach, Jonathan D. Neukam, Mario A. Svirsky**
Department of Otolaryngology, NYU Grossman School of Medicine, New York, NY, New York, NY, USA

In most cochlear implant (CI) coding strategies, acoustic information is encoded by modulating amplitude of electrical pulses delivered to implant electrodes. The rate at which electric pulses are delivered can be viewed as the update rate for amplitude modulations. Higher carrier rates permit encoding of more rapid acoustic envelope modulations, and might be beneficial for transmission of brief or fast-changing phonetic cues. However, there is evidence that high carrier pulse rates may be detrimental to the ability to detect amplitude changes (e.g. Azadpour et al. 2018). This study systematically investigates the effects of pulse rate on speech perception and temporal processing performance of CI users. A broad range of pulse rates was tested, which could provide a clearer understanding of the maximum and minimum pulse rates that should be utilized in clinical coding strategies without considerably impairing speech perception.

We evaluated the effect of pulse rate on speech perception by measuring consonant identification in a closed-set vowel-consonant-vowel identification task. The effect of pulse rate on temporal processing was evaluated by measuring detection thresholds for 25 Hz amplitude modulations applied to wide-band noise stimuli. Stimuli were processed with single- channel and ACE strategies on a PC, and were streamed to the implant via the CCI-Mobile platform. Single-channel strategies presented the overall envelope of the signal to an electrode in the middle of the electrode array. ACE strategies used the active electrodes in the subjects' clinical device. Number of maxima was typically 6. The tested pulse rates were 125, 250, 500, 1000, and 2000 pps/channel (pulses-per-second per channel). 4000 pps/channel was also included for the single-channel strategy. Threshold and comfort levels were obtained for each electrode and at each rate.

The results confirm inter-subject variability in the way performance in speech perception and modulation detection tasks changes with pulse rate. Overall, the highest performance in both tasks was achieved with the range of pulse rates between 250 and 2000 pps/channel. In most cases, performance dropped in both tasks as pulse rate was either increased or decreased beyond this range. Consonant recognition scores were lower with the single-channel strategies than with ACE, as expected. In contrast, modulation detection performance was better with the single-channel strategies. This interesting observation suggests that the inherent fluctuations in the narrow-band output of ACE strategy channels may distort representation of amplitude modulation cues in the stimuli.

The results so far do not show strong correlations between speech perception and modulation detection performance. Generally, these results support the hypothesis that excessively high or low stimulation rates could disrupt perception of speech temporal cues.

This work was supported by NIH-NIDCD R01DC016839 (Hansen/Litovsky/Svirsky) and NIH/NIDCD R01-DC03937 (Svirsky).