Cochlear Implant Centre | Department of Otorhinolaryngology

Effect of an ambient noise reduction algorithm on speech perception as a function of noise type in cochlear implant users

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Abstract

Cochlear implant (CI) users can gain improvement in noisy situations due to noise reduction algorithms. In the present study 20 postlingually deafend, adult CI users wearing a SONNET 2 audio processor from the manufacturer MED-EL were tested with the ambient noise reduction algorithm.

Speech perception was measured in the presence of four different noise signals, ranging from stationary noise (OlNoise, Cafeteria) to fluctuating noise (ICRA5-250) and a speech masker (ISTS). Speech was presented from the front (S0) and noise from the back (N±135). Patients were binaural hearing impaired. Regardless of the mode of treatment (unilateral, bimodal or bilateral CI) only one CI side was tested. The microphone characteristic was pinna imitating (“natural” mode). The noise reduction was randomly activated or deactivated.

Speech perception altered in the four noise conditions and improved in presence of one stationary noise and one fluctuating noise when the noise reduction algorithm was activated. The improvement did not only depend on the characteristics of the noise signals being stationary or fluctuating, but also on their frequency distribution.

Objectives

Investigating the impact of the ambient noise reduction algorithm on speech perception as a function of noise type

Methods & Material

Five-word sentences e.g. “Stefan sees eight wet pictures” (“Oldenburg-Sentences-Test (OLSA))[1] are presented against four different noise signals ranging from stationary to fluctuating noise (OlNoise, Cafeteria, ICRA5-250, ISTS). Each noise signal begins 60 sec. before the sentence and is presented continuously.

Measurements start at 65 dB SPL with a signal-to-noise ratio (SNR) of 0 dB. The measurement is adaptive to gain the 50% speech-reception threshold (SRT). Speech is presented from the front (S0°) and noise from the back (N±135°). Measurements are done with the noise reduction algorithm randomly activated or deactivated.

The listeners’ task is to repeat the sentence.

Results

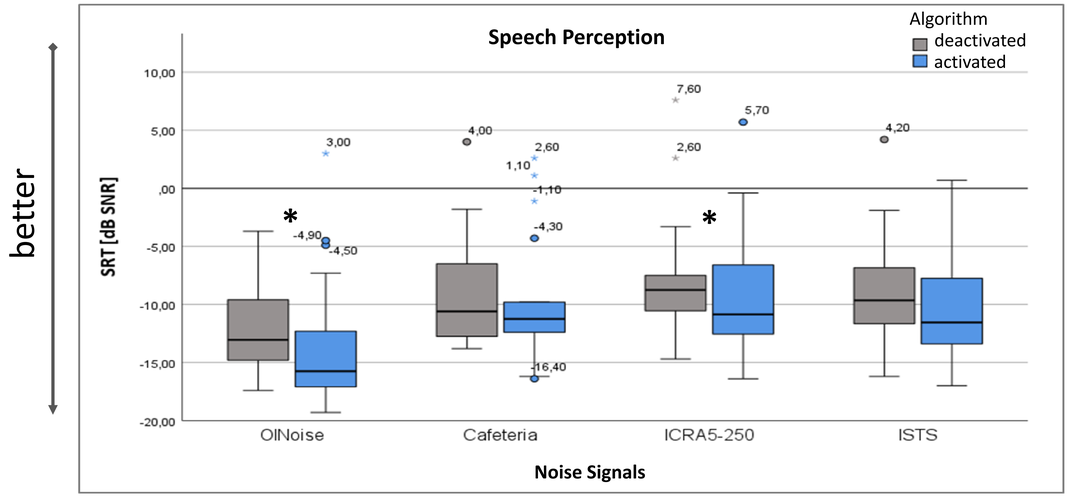

Figure 1: Speech perception (SRT 50%) above the 4 noise signals with the deactivated (grey) and activated (blue) noise reduction algorithm for the 20 CI users in S0° N±135°. Asterisks at OlNoise and ICRA5-250 show significant improvements with the acitvated algorithm.

Conclusion

Speech perception improves with the activated noise reduction algorithm for the OlNoise (stationary) and the ICRA5-250 noise (fluctuating). However, the improvement does not only depend on the fact of the noise signals being stationary or fluctuating. Analysis showed that CI users primarily benefit from the noise reduction algorithm when the noise signals have a dominant low-frequency region.

As speech perception was equal or better with the activated noise reduction, it can be recommended to use the ambient noise reduction algorithm in corresponding everyday situations.

References

[1] Wagener, K. &. Kollmeier, B. (2005). Evaluation des Oldenburger Satztests mit Kindern und Erwachsenen. Z. Audiol. 44, 134–143.