PRE-PROCESSING FOR COCHLEAR IMPLANT USERS IN DIFFICULT LISTENING ENVIRONMENTS

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Abstract

Cochlear Nucleus products provide the option to program a CI sound processor with several pre-processing strategies, which aim to improve the speech understanding performance in noisy environments. The goal of this study was to evaluate the performance of different pre-processing strategies in difficult listening environments. Two different speaker setups for speech understanding tests in background noise and two different type of noise were used. The tested combination of different pre-processing algorithms in Nucleus® CP810 provides better performance in less modulated background noise and in more realistic environments.

Key words: preprocessing • directional • Speech Perception

Background

Cochlear Nucleus products give the capability to program a CI sound processor with different pre-processing strategies for difficult listening situations. There have been recommendations for Nucleus® Freedom, but with Nucleus® CP810 new features have been introduced, like different directional modes. The new features have been combined to Smart Sound options, which need to be tested. Some of those features have been used in hearing aids as well and evaluated in difficult listening environments [1,2]. The goal of this study was to evaluate the performance of different pre-processing strategies under difficult listening conditions.

Material and methods

Two different speaker setups have been used for this investigation. The first speaker setup uses 6 speakers to present uncorrelated cafeteria-type noise and Olsa noise at 65 dB from ±70, ±135 and 180 degrees and adaptive sentences from the front (Figure 1).

The second setup is a typical S0N0 speaker condition with Olsa noise or cafeteria-type noise fixed at 65 dB and adaptive sentences and can be seen in Figure 2.

The 6 channel condition aims to simulate a more realistic environment. The cafeteria-type noise was identified as more modulated compared to the standard Olsa noise. Three subjects (≥18 years) have been recruited for the study. The speech intelligibility performance has been evaluated in acute measurements by comparing speech perception with the "6 channel condition" versus the S0N0 condition with two different types of background noise. For this investigation a combination of three different adaptive pre-processing algorithms has been used in all subjects.

Results

The results in Figure 3 show the same pattern for all subjects. Better performance was found with the less modulated Olsa noise compared to the more modulated cafeteria-type noise. Also the more realistic "6 channel condition"

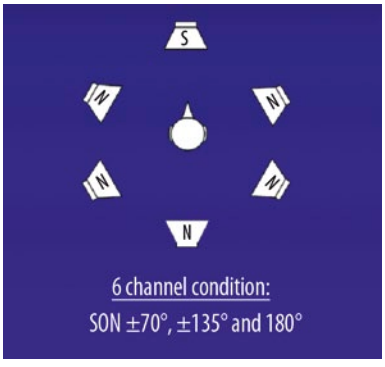

Figure 1. Speaker setup of the 6 channel condition.

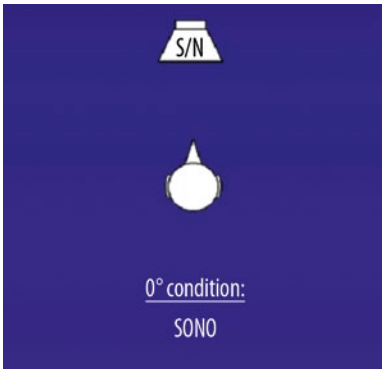

Figure 2. Speaker setup of the S0N0 condition.

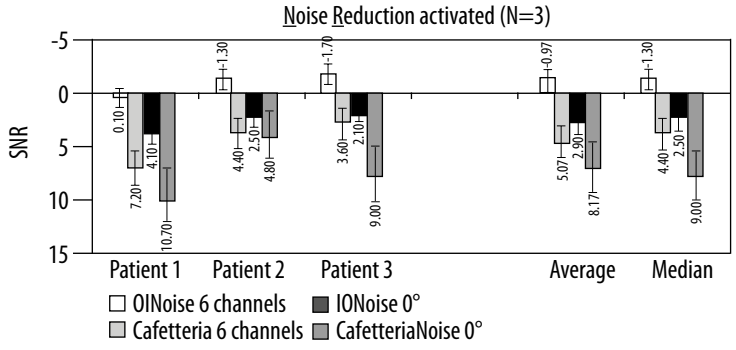

Figure 3. Speech understanding results.

lead to better speech understanding in background noise versus the standard S0N0 condition.

Discussion

The speaker setups as well as the type of background noise have an influence to the speech performance. The tested combination of different pre-processing algorithms in Nucleus® CP810 provides better performance in less modulated background noise. Another finding was that subjects with the Nucleus® CP810 perform better in more realistic environments. This result base on the fact that >2 dB difference with the Olsa sentence test provides already a clinical relevant difference [3]. But only one combination of pre-processing algorithms was tested.

Conclusions

Further research on this topic with other pre-processing strategies is required to give recommendations for Nucleus® CP810 in difficult listening situations.

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