P168/P173 Refs.:452/577

TOPIC: AUDITORY OBJECTIVE MEASURES

Objective brain measures to detect uncomfortable loudness levels for improving the fitting process of cochlear implants

Josef Seebacher[1], Sonja Rossi[1], Simone Graf[1], Patrick Zorowka[1], Joachim Schmutzhard[2], Philipp Zelger[1]

[1]Department for Hearing, Speech- and Voice Disorders, Medical University of Innsbruck, Innsbruck, Austria [2]Department for Otorhinolaryngology, Medical University of Innsbruck, Innsbruck, Austria

Background

The perceived loudness of a stimulus is of particular importance in the fitting of hearing aids and hearing implants. Today fitting methods mostly rely on determination of a lower level of stimulation (either acoustic or electric) and an upper level of stimulation often called comfort level. These measures define the dynamic range of stimulation. Beyond the comfort level an acoustic as well as an electric stimulus is perceived as too loud. Objective measures to quantify such uncomfortable loudness levels are currently not available in clinical routine.

In the present study the objectification of the subjective perception of loudness was investigated using electroencephalography (EEG). In particular, the emergence of objective markers in the domain of the acoustic discomfort threshold was examined.

Materials and Methods

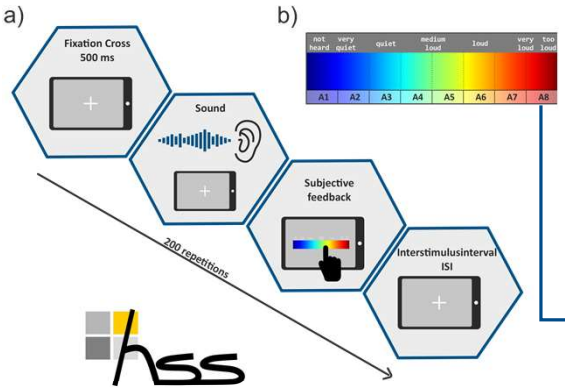
Subjects:
A cohort of 27 adults with normal hearing, aged between 18 and 30, participated in the study.

Test Paradigm:
A sequence of broadband noise bursts of 500ms duration were presented to the subjects in randomized order at different sound levels through insert ear phones. Particular stimulus levels were 55, 65, 75, 85 and 95 dB SPL (see right panel a).

Objective Measurement:
During presentation of the stimuli EEG signals were recorded at the skull of the subjects.

Subjective Feedback of the Subjects:
Simultaneously to EEG recording subjects had to rate the perceived loudness of each stimulus right after its presentation on a seven-point Likert scale. (see right panel b)

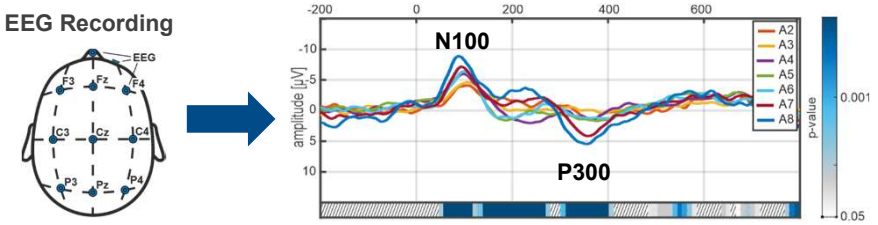
Data Analysis:
Particular event-related potentials (ERPs) analyzed were the N100 and P300 components of the EEG signal.



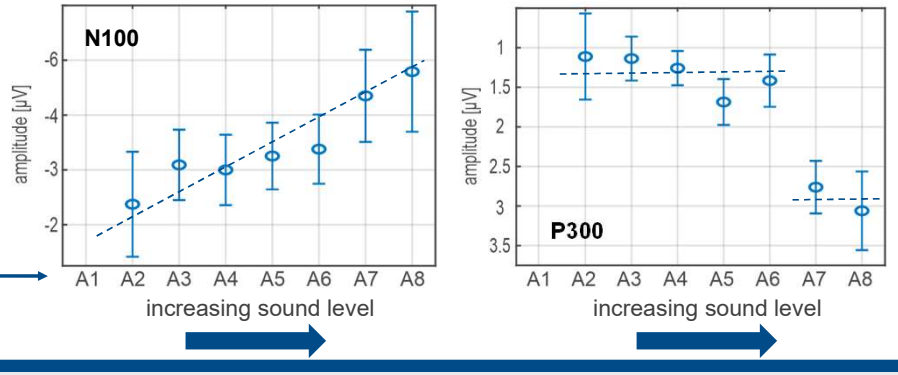
Department for Hearing, Speech and Voice Disorders
Medical University of Innsbruck
Austria

Philipp.Zelger@i-med.ac.at
Josef.Seebacher@i-med.ac.at

Results



The N100 component (potential appearing 100ms after onset of the stimulus) showed a linear growth with increasing sound level as reported in previous studies. For higher sound levels close to the subjective discomfort level a P300 component appeared (potential visible 300ms after stimulus onset).



Conclusion

Take home message: Uncomfortable loudness levels may be detectable objectively in brain potentials such as the P300 component.

more details here: Philipp Zelger , Josef Seebacher , Simone Graf , Sonja Rossi , Is it too loud? Ask your brain!, *NeuroImage* (2024), doi: https://doi.org/10.1016/j.neuroimage.2024.120796