Evaluation of an artifact reduction strategy for electrically evoked auditory steady state responses: Simulations and Measurements

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Background
Electrically evoked steady state response (EASSR) recording is a measure of neuronal response strength after continuous electrical stimulation of the auditory system. In order to suppress the large electrical artifact generated by intracochlear electrical stimulation, a sophisticated artifact reduction processing strategy has been proposed (Hofmann and Wouters 2010).
So far, EASSR recordings with sophisticated artifact reduction procedures were reported only in cochlear implant (CI) users implanted with Cochlear devices (Macquarie, Australia).

Method
Here, we demonstrate the application of the Hofmann procedure in CI users implanted with MED-EL (Innsbruck, Austria) devices.
In order to figure out potential limitations of the procedure, we calculated discrete time Fourier transformations (DTFT) by means of fast Fourier transformation (FFT) of various pulse patterns which may be used for EASSR.

Results
EASSR recordings were obtained in three subjects and processed with the Hofmann procedure. Neural response amplitude growth functions and phase of various stimulation rate and mode could be assessed. Simulations of three different interpolation methods aimed to suppress the electrical artifact show that the interpolation of a sinusoidal signal in a temporal window between 0-1 ms demonstrate negligible impact on the spectral amplitude of the signal with a superior performance of a spline interpolation.

Conclusion
It is feasible to record EASSRs with the described measurement setup and cochlear implants from the manufacturer MED-EL.