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Removal of cochlear implant artefacts from EEG recordings

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Cochlear implants (CI) can compensate for sensori-neural hearing loss. One objective and non-invasive way of assessing auditory cortex functions after implantation is by means of auditory evoked potentials (AEPs), but AEPs are typically contaminated by electrical artefacts. As the artefact is time-locked to the stimulation averaging alone cannot be used to recover AEPs. It has been reported that independent component analysis (ICA) can solve the problem. To further investigate the validity of ICA, electroencephalogram (EEG) data were collected from 18 CI users presented with auditory and visual stimuli. Specifically, the sensitivity and specificity of ICA for attenuating CI artefacts was analysed. ICA sensitivity was quantified by computing the amount of artefact attenuation. The quality of AEPs was evaluated based on a signal to noise ratio (SNR) measure and compared to age-matched normal hearing (NH) controls. ICA specificity was assessed with a hybrid simulation study where CI artefacts were added to the EEG from NH listeners. In addition, visual evoked potentials recorded from CI users were compared before and after CI artefact attenuation. Overall, the results indicated good ICA sensitivity and specificity. AEPs with a reasonable SNR could be recovered from most CI users. Moreover, systematic correlations between AEPs and age were obtained for CI users and NH controls, suggesting that individual differences were preserved. Finally, a systematic relationship between AEP SNR and duration of deafness was found, as could be expected. Taken together, the results support the validity of ICA for the study of late AEPs in CI users.

Literatur: Debener, S., Hine, J., Bleck, S., & Eyles, J. (2008). Source localization of auditory evoked potentials after cochlear implantation. *Psychophysiology*, 45(1), 20-24. Sandmann, P., Eichele, T., Buechler, M., Debener, S., Jancke, L., Dillier, N., et al. (2009). Evaluation of evoked potentials to dyadic tones after cochlear implantation. *Brain*, 132(Pt 7), 1967-1979. Sandmann, P., Kegel, A., Eichele, T., Dillier, N., Lai, W., Bendixen, A., et al. (2010). Neurophysiological evidence of impaired musical sound perception in cochlear-implant users. *Clin Neurophysiol*, 121(12), 2070-2082.

