Abstract DGA 2011

Beitrag wird präsentiert am 10.03.2011 um 11.00 Uhr im Rahmen der SS01.

Electrophysiological correlates of cortical plasticity in cochlear-implant users

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There is growing evidence that sensory deprivation can cause cross-modal plastic changes in cortical function. Although these compensatory changes might have beneficial effects on the remaining modalities during the period of sensory deprivation, they may have detrimental consequences for cortical reorganization after restoration of the sensory input. Accordingly, in cochlear-implant (CI) users, cross-modal changes in the auditory cortex may hinder the adaptation of the auditory cortex to the artificial input provided by the CI. In order to better understand cortical changes in CI users, the present EEG study used different checkerboard images to compare visual-evoked potentials (VEPs) between postlingually deafened CI users and age- and gender-matched normal-hearing controls. The results showed smaller P100 VEP amplitudes in CI users compared to normal-hearing listeners. Three-dimensional source analysis of VEPs at P100 latency revealed reduced activity in the visual cortex of CI users, with the strongest group differences located over the secondary visual cortex (BA 18). Interestingly, CI users but not normal-hearing listeners showed additional activation of the auditory cortex at P100 latency. The results suggest that CI users not only recruit the visual cortex but also the auditory cortex during visual information processing, supporting the view of cross-modal changes in the auditory cortex of CI users. We speculate that even postlingual onset of profound hearing loss can cause cross-modal changes in the auditory cortex, and that these compensatory changes are not completely reversed, even after many years of implant usage.