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Deterioration of frequency discrimination by contralateral noise in subjects with noise-induced hearing loss

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Partial lesions of the cochlea in adult experimental animals result in plastic changes of confound frequency representation in the contralateral auditory cortex, to the effect of an increased neural representation of frequencies corresponding to the 'edge frequency' of the lesion. Also in human subjects with cochlear damage, differences in monaural performance near the cut-off frequency of steep sloping high-frequency hearing loss are assumed to be the result of injury-induced neural reorganization. This might have consequences for human binaural hearing, which is known to improve speech perception in noisy environment (cocktail party effect). Theses situations cause difficulties for subjects with an occupational noise-induced hearing loss. We examined this by comparing monaural discrimination abilities at suprathreshold levels to the condition with an additional presentation of contralateral broad-band noise bursts.
Difference limens (DLs) for frequency, intensity and duration were measured in 18 male subjects (median age 63,5 years) with occupational noise-induced hearing loss. The tests were carried out at the audiogram cut-off frequency (COF) and in a frequency one octave below (NHF). The COF was defined as the test-frequency at the beginning of the slope with no elevated threshold (compared to a group of normal hearing subjects of the same age). Signals were presented 30 dB SL.
Compared to control subjects of the same age, frequecy DLs in presence of contralateral noise were significantly elevated at COF, but not at NHF, or under monaural conditions. No differences in the performance were found for intensity and duration discrimination.
The results show a binaural perceptual deficit of central origin, reflecting deficits in neural integration at the level of the cortex and/or feedback control mechanisms, i.e. via the medial olivocochlear bundle.