Hidden hearing loss with envelope following responses (EFRs): The off-frequency problem

Recent animal studies have shown that noise over-exposure can cause the loss of auditory nerve (AN) fiber synapses without causing hair cell loss (see Kujawa and Liberman (2015) for a review). This AN fiber synapses loss has been termed "hidden hearing loss" or "synaptopathy", since it is not reflected in the traditional puretone threshold. The envelope following response (EFR) has been proposed as a potential objective method to assess synaptopathy in humans (i.e., Bharadwaj et al., 2015). Encina-Llamas et al., (2016) reported different trends in EFR levelgrowth functions recorded using two modulation depths in normal-hearing (NH) and mild hearingimpaired (HI) listeners. The EFR is a gross encephalographic potential that represents the encoding of the envelope of the stimulus, arising from synchronized neural activity from all excited frequencies and fibers. In this study, an computational model of the AN was used to investigate the effects of off-frequency contributions (i.e. away from the characteristic place of the stimulus) and the differential loss of different AN fiber types on EFR level-growth functions.

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