Distortion-product otoacoustic emission reflection-component delays and cochlear tuning: Estimates from across the human lifespan

A consistent relationship between reflection-emission delay and cochlear tuning has been demonstrated in a variety of mammalian species, as predicted by filter theory and models of otoacoustic emission (OAE) generation. As a step toward the goal of studying cochlear tuning throughout the human lifespan, this paper exploits the relationship and explores two strategies for estimating delay trends—energy weighting and peak picking—both of which emphasize data at the peaks of the magnitude fine structure. Distortion product otoacoustic emissions (DPOAEs) at 2f1f2 were recorded, and their reflection components were extracted in 184 subjects ranging in age from prematurely born neonates to elderly adults. DPOAEs were measured from 0.5–4 kHz in all age groups and extended to 8 kHz in young adults. Delay trends were effectively estimated using either energy weighting or peak picking, with the former method yielding slightly shorter delays and the latter somewhat smaller confidence intervals. Delay and tuning estimates from young adults roughly match those obtained from SFOAEs. Although the match is imperfect, reflection-component delays showed the expected bend (apical-basal transition) near 1 kHz, consistent with a break in cochlear scaling. Consistent with other measures of tuning, the term newborn group showed the longest delays and sharpest tuning over much of the frequency range.

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