Abstract:

Distortion product otoacoustic emissions (DPOAEs) and auditory steady state responses (ASSRs) each provide frequency specific and quantitative assessment of hearing capability (Boege and Janssen, 2002; Gorga et al. 2003; Herdman and Stapells 2001, Dimitrijevic et al. 2002). Simultaneous DPOAE/ASSR measurements could improve the test performance. Tone pairs are necessary for DPOAE/ASSR measurements. However, the optimal tone separation for yielding maximum amplitude of the two measures is different (beat frequency $f_m = f_2 - f_1$ = 40, 80, 160 Hz for ASSR being independent of test frequency (carrier frequency fc); primary tone separation $f_2 - f_1$ for DPOAE being dependent of test frequency f_2). Thus, when elicting both DPOAEs and ASSRs by the same tone pair optimal tone separation is only present for one of the two measures and thus simulataneous measurements are only possible at distinct test frequencies (Purcell et al. 2003).
One way out of this dilemma is a stimulus setting in which one tone of the tone pair is amplitude-modulated. In doing this, the optimal tone separation for eliciting DPOAEs at any beat frequency for eliciting ASSRs across test frequency (f_2; f_c) is ensured.
In the present study ASSRs and DPOAEs were measured in 10 normally hearing subjects using an amplitude-modulated (f_m = 40 Hz, modulation depth = 100 %) primary tone $f_2 = f_c$ at 0.5, 1, 2, 4, 6, 8 kHz in combination with a second (unmodulated) sinusoidal tone f_1 (f_2/f_1 = 1.2). Influences of modified stimuli on each response were quantified with respect to loss of amplitude.
DPOAE level and ASSR amplitude were lower in the simultaneous compared to that obtained in the single mode. However, mean difference across test frequency for DPOAE level was lower than 3 dB, for ASSR amplitude was lower than 150 nV. Difference for both measures was not significant (F-test).
Findings suggest the approach to be a suited means for assessing hearing capability using DPOAEs and ASSRs. Further investigations are necessary for benefit from advantages of each of the measures.