Middle ear and cochlear disorders result in different DPOAE growth behaviour: implications for the differentiation of sound conductive and cochlear hearing loss.

Abstract:
Input/output functions of distortion product otoacoustic emissions (DPOAE I/O-functions) give an insight into the compressive, non-linear sound processing of the cochlea. With an inner ear dysfunction a steeper I/O-function is observed. Due to the linear sound processing of the middle ear, one can assume that the DPOAE growth behaviour remains unaltered with a sound conduction dysfunction. If that is true, a differentiation between middle and inner ear dysfunction will be possible by using the slope of DPOAE I/O-functions as a means for assessing cochlear compression. In order to test that hypothesis, DPOAE I/O-functions were recorded in a wide primary tone level range at up to 8 f2 frequencies between 2.0 and 8.0 kHz (15 dB SPL < L2 < 60 dB SPL; L1 = 0.46 L2 + 41 dB SPL; f2/f1 = 1.2) in guinea pigs in which middle (saline solution in the bulla) and inner ear (exposure to loud broadband noise) disorders were induced. Middle ear dysfunction resulted in a reduction of the DPOAE amplitude independent of the primary tone level. Consequently, DPOAE growth behaviour was not affected. In contrast to that, during cochlear impairment, steepened DPOAE I/O-functions were observed reflecting loss of compression of the cochlear amplifier. Accordingly, DPOAE I/O-functions allow a differentiation between middle and inner ear dysfunction. Further studies will have to show the usability of this method for
clinical diagnostics, e.g. for detecting sound conduction disturbances in newborn hearing screening due to amniotic fluid or Eustachian tube dysfunctions during the early postnatal period.

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