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Otoacoustic emissions as a test for mild hearing loss early detection

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BACKGROUND: OAE techniques provide a great deal of information about the most delicate mechanism of the cochlear function, namely the active feedback mediated by the OHCs, which are typically the first part of the auditory system to be significantly affected by the exposure to important ototoxic agents, such as noise and drugs. Therefore, OAEs have been considered as a very promising tool to detect mild hearing loss in exposed subjects. The large inter-subject variability of the OAE levels makes it difficult to design OAE-based tests capable of directly evaluating the hearing threshold in a single subject. The aim of this work was at investigating the effectiveness of OAE-based tests for the detection of very low levels of noise-induced hearing loss.

METHODS: Audiometric and otoacoustic (TEOAE and DPOAE) data have been recorded in a population of 217 young workers (age: 18-35) exposed to different levels of industrial noise. All measurements have been performed, during routine occupational health surveillance, with a standard clinical apparatus and acquisition procedure, which can be easily used in the occupational safety practice.

RESULTS: The correlation between TEOAE SNR, DPOAE level and the audiometric threshold has been studied, investigating the intrinsic causes of the rather large inter-subject variability of the OAE levels. The data analysis has shown that, if both OAE data and audiometric data are averaged over a suitably large bandwidth, the correlation between DPOAE levels and audiometric hearing threshold is sufficient to design OAE-based diagnostic tests with good sensitivity and specificity also in a very mild hearing loss range, between 10 and 20dB.

CONCLUSIONS: DPOAE and, to a lesser extent, TEOAE levels are sensitive to mild hearing loss, and the investigation of their generation mechanism helps developing appropriate OAE-based tests for the early detection hearing impairment in exposed subjects.

