Comparison of peripheral compression estimates using auditory steady-state responses (ASSR) and distortion product otoacoustic emissions (DPOAE)

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**ABSTRACT**

The healthy auditory system shows a compressive input/output (I/O) function as a result of healthy outer hair cell function. Hearing impairment often leads to a decrease in sensitivity and a reduction of compression, mainly caused by loss of outer hair cells and/or fibrosis. Compression is commonly estimated based on behavioral procedures (Plack et al., 2004), which are time consuming and rely on assumptions regarding the ability to selectively investigate cochlear processing or on objective recordings such as distortion-product otoacoustic emissions (DPOAEs) (Neely et al., 2003), which allow to selectively study cochlear processing but the interpretation of results for individual data is challenging.

Auditory steady-state responses (ASSR) are another objective method which allows fast, reliable and frequency-specific measurements of hearing function. It is hypothesized that compressive behavior is observed in normal-hearing (NH) listeners while in hearing-impaired (HI) listeners, sensitivity and compression are reduced. ASSR data are later compared to data from distortion-product otoacoustic emissions (DPOAEs) recordings.

Results show compressive ASSR I/O functions for NH subjects. For HI subjects, ASSR reveal the loss of sensitivity at low stimulus levels. Growth slopes are smaller (more compressive) in ASSR than in DPOAE I/O functions.

**HYPOTHESIS**

Peripheral compressibility can be estimated through ASSR I/O functions in NH subjects. HI subjects show a change in sensitivity and compression estimate.

How do compression estimate correlate when measured using ASSRs versus DPOAEs?

**RESULTS**

- NH subjects consistently show compressive functions with slopes between 0.1 and 0.5 dB/dB.
- ASSR saturates or even decreases at higher stimulus levels.
- Repeated points (a) recorded in different sessions show small variability in the response.

**CONCLUSIONS**

- HI subjects show higher variability in the results.
- Significant responses at input levels of 30 dB SL and above have been obtained for HI subjects.
- ASSR I/O functions in HI subjects reflect the loss of sensitivity at lower stimulus levels.
- Compression estimate from DPOAE I/O functions was obtained using the method proposed by Neely et al. (2003).

**METHODS**

- **ASSR** (20 subjects. 13 NH and 7 HI)
  - 64-channel EEG system with active electrodes (Biosens). ASSR magnitude obtained from the recorded ASSR spectrum, computed from the weighted averaged waveform.
  - Detection of significant results using F-test (p-value ≤ 1%)
- **DPOAE** (12 NH subjects)
  - Fitting curves
  - Least-squares-fit (LSF) method used to obtain the magnitude and phase of the 2f1 − f2 DPOAE component.
- DPOAEs recorded using a time windowing technique (Long et al., 2008).

**DISCUSSION**

Slopes of growth I/O functions for ASSR vs DPOAE.

**REFERENCES**

