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Canal obliquity and stapes velocity transfer function

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Purpose: The goal of our experiments is to evaluate factors that affect upon the middle ear transfer function. For the better understanding of middle ear mechanics we need to know factors that affect upon the middle ear transfer function measured by a laser Doppler vibrometer. In this paper we tried to figure out the effects of dryness, the position of the probe tube microphone (PT mic) and the ear plug, aerated cochlear in preliminary experiments and focused on the effect of canal obliquity.

Material and Methods: Ten temporal bones were used. A laser Doppler vibrometer (HLV-1000) measured the stapes velocity (V_{st}). First, measurements were made with the natural EAC. After measurements with N-EAC, the bony canal was drilled and V_{st} with A-EAC was measured with the same bone. The sound stimulus for all measurements was a chirp swept over 200 logarithmically-spaced frequency points from 0.1 to 25 kHz. All measurements were performed using SYSid 6.5. This software program with a DSP-16+ processing board produces an output signal used to drive a sound source, and synchronously measures and averages the magnitude and phase angle of two input signals at each frequency.

Results: Dryness decreased the SVTF by 5 dB at low frequencies by leaving the specimen in a room with 30 % humidity for 6 hours. The position of PT mic significantly changed the SVTF at high frequencies. At 8 kHz 10 mm difference with PT mic position caused 20 dB elevations in SVTF magnitude. Aerated cochlear seemed to increase the SVTF by 5 to 15 dB at frequencies from 1 to 10 kHz (preliminary experiments). The mean SVTF (V_{st}/P_{eac}) with A-EAC was similar with previous report, and the difference between SVTF with N-EAC and with A-EAC were less than 5.2 dB in magnitude and less than 45 degrees in phase angle at frequencies between 0.1 and 15 kHz.

Conclusion: Significant difference between SVTF with N-EAC and A-EAC were not detectable. The most influential factor that affects upon SVTF at high frequencies was the position of the probe tube microphone