Nasal Sound Pressure measurement as an intraoperative objective measure for transcutaneous Bone Conduction Instruments

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Introduction
Bone conduction hearing instruments provide hearing for patients with outer or middle ear disorders by simulating skull vibrations and thus stimulating the cochlear fluids. The aim of the study was to develop a method, which can be used during surgery in order to assure the functionality of the implant. Second aim was to reduce the inter-subject variability of the measurements.

Method
Normal hearing subjects:
Twenty normal-hearing subjects (10 ♂, 10 ♀) participated in the study. Hearing condition was ensured by an audiometric threshold test. All participants who had hearing level ≤20 dB HL and an inter-aural difference ≤15 dB HL were included in the study.

Nasal Sound Pressure:
The Nasal Sound Pressure (NSP) was measured in the nostrils by a microphone under stimulation of the skull by a bone conductor.

The bone vibrator used for stimulation was placed at two different positions (A, B) and was held in place by a steel spring headband (Fig. 1B).

Averaging:
A center moving average method with 5, 11, 21, 41 lines was applied to NSP amplitudes (Fig. 2).

Conclusion
NSPs were measurable with sufficient signal-to-noise ratio (SNR>10 dB) at frequencies between 100 and 8000 Hz. Results imply that NSP can potentially be used as an alternative to ear canal sound pressure measurement in patients with ear canal atresia. The position closer to the ear canal provided higher NSP amplitude in average data.