Towards development of objective test to diagnose cochlear dead regions using Acoustic Change Complex

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Abstract

The loss of inner hair cells and/or neurons in the cochlea leads to cochlear dead regions (DRs). One of the consequences of DRs is noisy transmission of information from the cochlea to the brain, which results in poorer than expected perception of speech in noise. DRs can be detected using behavioural masking techniques such as threshold-equalizing noise (TEN) test. However, the TEN test although fast and easy to perform, requires participant's active cooperation and thus is not suitable for use with infants, young children and adults who cannot provide behavioural responses. Recently, Kang et al. (2018) proposed the Acoustic Change Complex (ACC) as an objective test for diagnosing cochlear dead regions, but with limited evidence supporting their proposed approach. Thus, the first step towards addressing this gap is to develop and assess objective ACC detection method. Here, we evaluated three methods of detecting the ACC based on: a) root mean square of N1-P2 amplitude as reported in Kang et al. (2018); b) Signal-to-Noise Ratio as recommended by British Society of Audiology; and c) bootstrap by multiple resampling of the original data in a random manner and calculating measure of the variance in the N1-P2 amplitude to noise floor ratio from the resampled data. We have also examined the relationship between ACC amplitude, threshold and stimulus frequency/intensity. Twenty three normally hearing adults were tested. The ACC was evoked by either 1 kHz or 4 kHz pure tone presented simultaneously with the TEN at SNRs between 0 and 15 dB, in 3dB steps relative to the TEN level. We found that the bootstrap method was most efficient at detecting ACC and was two-times faster to administer than the commonly used British Society of Audiology method. We also found that the threshold of ACC detection is frequency dependent, i.e. the higher the frequency, the higher the level of signal needed to evoke ACC. Thus, frequency-dependent ACC norms need to be established before this method can be used for detection of cochlear dead regions in children and adults who cannot provide behavioural responses. *Ref:* Kang, S., Woo, J., Park, H., Brown, C. J., Hong, S. H., and Moon, I. J. (**2018**). "Objective Test of Cochlear Dead Region: Electrophysiologic Approach using Acoustic Change Complex," *Sci Rep*, 8, 3645. doi:10.1038/s41598-018-21754-7

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