Comparison of Contralateral Wideband and Single-Frequency Acoustic Reflex Thresholds in Normal-Hearing Adults

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INTRODUCTION: The ear can be divided into three portions: the outer ear, the middle ear, and the inner ear. Through the middle ear cavity sounds are transmitted from the eardrum into the inner ear. When a loud sound enters the ear, a muscle in the middle ear reflexively contracts. To monitor this reflex, a technique known as acoustic reflex (AR) has been used in audiology practice for decades. In testing, a single-frequency probe tone (226 or 1000 Hz) is presented in the ear canal, along with another loud sound that activates the reflex. AR may be tested with the probe in one ear and the activator in the opposite ear, known as contralateral AR. A commonly used measure is threshold, which is defined as the lowest activator level that elicits the reflex. This procedure is used to help diagnose ear diseases, but it has some limitations. The wideband acoustic reflex (WAR) procedure is a new technique using clicks as probe signals, which covers a broad range of frequencies (226 Hz to 8000 Hz). Several previous studies have suggested that the WAR test is more sensitive on monitoring the middle-ear reflex and provides more information about middle ear function. The WAR technique requires more studies before it can be used as a clinical tool.

PURPOSE: This study compared WAR and AR thresholds using various probe tones and reflex activators in normal hearing young adults.

METHODS: Thirty-three young adults (mean age: 23.1 ±3.8 years) were recruited with normal hearing and middle ear function. Contralateral WAR and AR tests with 226- and 1000-Hz probe tones were conducted with five activators: four tone bursts (500, 1000, 2000, and 4000 Hz) and broadband noise. The 226- and 1000-Hz AR thresholds (ART_{226Hz} and ART_{1000Hz}) were determined by repeatable response criterions of 0.03 and 0.13 mmho, respectively. WAR thresholds were automatically determined with a detection algorithm and maximum likelihood technique in the system. Two bandpass WAR thresholds were calculated: Low frequency (380‒2800 Hz, WART_{LF}) and high frequency (2800‒8000 Hz, WART_{HF}).

RESULTS: Mean data across ears showed that the WART_{LF} was lower than both ART_{226Hz} and ART_{1000Hz} for all activators. A two-way repeated-measures ANOVA followed with a Bonferroni t-test indicated that all differences were statistically significant (p<0.01). Median data revealed that WART_{LF} and WART_{HF} were on average 10 to 20 dB lower than ART_{226Hz}. There was no significant difference between ART_{226Hz} and ART_{1000Hz}. Descriptive statistics were conducted for both WAR and AR normative data.

CONCLUSION: WAR thresholds are 10-20 dB lower than single-frequency AR thresholds. The WAR procedure is more sensitive to register middle-ear reflexes. The results are promising to extend testing to patients with reflex thresholds elevated beyond the limits of current clinical AR systems.