Abstract:

Background: Large variations in perceptual directional microphone benefit, which far exceed the variation expected from physical performance measures of directional microphones, have been reported in the literature. The cause for the individual variation has not been systematically investigated.

Purpose: To determine the factors that are responsible for the individual variation in reported perceptual directional benefit.

Research Design: A correlational study. Physical performance measures of the directional microphones obtained after they had been fitted to individuals, cognitive abilities of individuals, and measurement errors were related to perceptual directional benefit scores.

Study Sample: Fifty-nine hearing-impaired adults with varied degree of hearing loss participated in the study.

Data Collection and Analysis: All participants were bilaterally fitted with a Motion behind-the-ear device (500 M, 501 SX, or 501 P) from Siemens according to the NAL-NL2 prescription. Using the BKB sentences, the perceptual directional benefit was obtained as the difference in speech reception threshold measured in babble-noise (SRTn) with the devices in directional (fixed hyper-cardioid) and in omnidirectional mode. The SRTn measurements were repeated three times with each microphone mode. Physical performance measures of the directional microphone included: the angle of the microphone ports to loudspeaker axis, the frequency range dominated by amplified sound, the in situ signal-to-noise ratio (SNR), and the in situ three-dimensional, articulation-index weighted directivity index (3D AI-DI). The cognitive tests included: auditory selective attention, speed of processing, and working memory. Intra-participant variation on the repeated SRTNs and the inter-participant variation on the average SRTn were used to determine the effect of measurement error. A multiple regression analysis was used to determine the effect of other factors.

Results: Measurement errors explained 52% of the variation in perceptual directional microphone benefit (95% CI: 34% to 78%), while another 37% of variation was explained primarily by the physical performance of the directional microphones after they were fitted to individuals. The most contributing factor was the in situ 3D AI-DI measured across the low frequencies.

Conclusions: Repeated SRTn measurements are needed to obtain a reliable indication of the perceptual directional benefit in an individual. Further, to obtain optimum benefit from directional microphones the effectiveness of the microphones should be maximised across the low frequencies.