The effect of hearing aid technologies on listening in automobiles

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Background: Communication while traveling in automobiles is often difficult for hearing aid users. This is because the automobile/road noise level is usually high, and listeners/drivers often do not have access to visual cues. Since the talker of interest is not usually located in front of the driver/listener, conventional directional processing that places the directivity beam toward the listener’s front might not be helpful, and could be detrimental to speech recognition. Recently, technologies have become available in commercial hearing aids that are designed to improve speech recognition in noisy automobiles. These technologies include (1) a directional microphone system that uses a backward-facing directivity pattern (Back-DIR processing) and (2) a technology that transmits audio signals from the ear with the better signal-to-noise ratio (SNR) to the ear with the poorer SNR (Side-Transmission processing). The purpose of the current study was to determine the effect of (1) conventional directional microphones and (2) newer signal processing schemes on listener’s speech recognition performance and preference for communication in an automobile.

Methods: Twenty-five adults with bilateral symmetrical sensorineural hearing loss aged 44 through 84 years participated in the study. The automobile/road noise and sentences of the Connected Speech Test (CST) were recorded through hearing aids in a standard van moving at a speed of 70 miles/hour on a paved highway. The hearing aids were programmed to omnidirectional microphone, conventional adaptive directional microphone, and the newer schemes. CST sentences were presented from the side and behind the hearing aids, which were placed on the ears of a manikin. The recorded stimuli were presented to listeners via earphones in a sound treated booth to assess speech recognition performance and preference with each programmed condition.

Results: Compared to omnidirectional microphones, conventional adaptive directional processing had a detrimental effect on speech recognition when speech was presented from the side or behind the listener. Back-DIR and Side-Transmission processing improved speech recognition performance (relative to both omnidirectional and adaptive directional processing) when speech was from the back and side, respectively. The participants’ preferences for a given processing scheme were generally consistent with speech recognition results.

Conclusions: The finding that performance with adaptive directional processing was poorer than with omnidirectional microphones demonstrates the importance of selecting the correct microphone technology for different listening situations. The results also suggest the feasibility of using hearing aid technologies to provide a better listening experience for hearing aid users in automobiles.