Effects of Hearing Loss and Fast-Acting Compression on Amplitude Modulation Perception and Speech Intelligibility

Objective: The purpose was to investigate the effects of hearing-loss and fast-acting compression on speech intelligibility and two measures of temporal modulation sensitivity.

Design: Twelve adults with normal hearing (NH) and 16 adults with mild to moderately severe sensorineural hearing loss were tested. Amplitude modulation detection and modulation-depth discrimination (MDD) thresholds with sinusoidal carriers of 1 or 5kHz and modulators in the range from 8 to 256 Hz were used as measures of temporal modulation sensitivity. Speech intelligibility was assessed by obtaining speech reception thresholds in stationary and fluctuating background noise. All thresholds were obtained with and without compression (using a fixed compression ratio of 2:1).

Results: For modulation detection, the thresholds were similar or lower for the group with hearing loss than for the group with NH. In contrast, the MDD thresholds were higher for the group with hearing loss than for the group with NH. Fast-acting compression increased the modulation detection thresholds, while no effect of compression on the MDD thresholds was observed. The speech reception thresholds obtained in stationary noise were slightly increased in the compression condition relative to the linear processing condition, whereas no difference in the speech reception thresholds obtained in fluctuating noise was observed. For the group with NH, individual differences in the MDD thresholds could account for 72% of the variability in the speech reception thresholds obtained in stationary noise, whereas the correlation was insignificant for the hearing-loss group.

Conclusions: Fast-acting compression can restore modulation detection thresholds for listeners with hearing loss to the values observed for listeners with NH. Despite this normalization of the modulation detection thresholds, compression does not seem to provide a benefit for speech intelligibility. Furthermore, fast-acting compression may not be able to restore MDD thresholds to the values observed for listeners with NH, suggesting that the two measures of amplitude modulation sensitivity represent different aspects of temporal processing. For listeners with NH, the ability to discriminate modulation depth was highly correlated with speech intelligibility in stationary noise.