Two Digital Noise Reduction (DNR) algorithms were used in two different commercial, available hearing aids evaluated in this study. The first model (HA-S) used comparatively fast time constants in its DNR algorithm, while the second model (HA-F) used faster time constants. Speech recognition in noise thresholds were gathered during the Hearing in Noise Test (HINT) for conditions of active and inactive DNR processing. Implementation of the DNR algorithm resulted in significantly decreased performance for subjects when fit with HA-S. In contrast, significantly improved performance was associated with activating the DNR algorithm in HA-F (Figure 1). This improvement likely originates from the extremely fast attack and release time constants used in the DNR algorithm.

One significant effect of DNR activation was observed within HA-F between active and inactive DNR conditions, F(1,14)=16.561, p < .001. A significant interaction was observed at 1000Hz for an input level of 50 dB (Figure 2). The hearing in noise test (HINT) was used to assess speech recognition in noise under five test conditions (two hearing aid types with the noise reduction system active and passive conditions). Each of the test conditions was evaluated using four test sentences randomly selected without replacement. Presentation order was counter-balanced across conditions. A period of 5-10 seconds of steady noise preceded the onset of speech stimulus to ensure the noise reduction algorithms were active. A single source loudspeaker (Tannoy System 600™) placed at 0˚ azimuth relative to the listener was used for all testing. All testing was performed in an anechoic chamber (3m x 3m x 3m).

Hyposthesies

On average, hearing aids will show similar speech recognition in a background of steady-state noise when fitted with two commercial digital hearing aids with DNR deactivated and matched for output.

The implementation of a DNR system with fast time constants will result in improved speech recognition in a background of steady-state noise in comparison to the same hearing aid with DNR deactivated.

The implementation of DNR processing with slow time constants resulted in a significant decrease in performance. While no improvement in speech recognition performance was expected for HA-S fittings, a decrease in performance was unexpected. Electroacoustic evaluation suggested that gain did not reach target levels for speech until 500 msec after the onset of the speech signal (Figure 4). This reduction period was long enough that it may have compromised individual speech recognition due to lack of audibility during the period of gain restoration. This research was funded in part by the Dan Maddox Hearing Aid Research Laboratory.

REFERENCES