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Hearing Aid Features and Expected Benefit

Hearing Aid Feature	Expected Patient Benefit
Automatic gain control-input (AGC-I)	The gain that is applied to the input varies based on the input level—more gain for soft sounds than for loud. Allows for packaging a wide range of input levels into the residual dynamic range of the patient.
Automatic gain control-output (AGC-O)	Sets the "ceiling" for the hearing aid output, which is programmed frequency-specific to fall just slightly below the patient's loudness discomfort level (LDL). Limits sounds abruptly with minimal distortions.
Multiple processing channels	Modern hearing aids often have as many as 32 to 48 (or more) frequency channels. This allows for adjustments in gain, output and signal processing to be made in small individual frequency regions, depending on patient specific characteristics.
Multiple memories	A "memory" is fitting parameters that can be programmed totally different than other memories. A patient may have special programs for listening to music or listening in a car. For most situations, the hearing aid automatically selects the most optimum programing for a given listening situation, as determined by the signal classification system. A toggle switch, remote control, or smartphone app allows changes to different programed settings by the patient.

Portions of this Table were adapted from Mueller and Jorgensen (2020), Hearing Aids for Speech-Language Pathologists. Plural Publishing.

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Signal classification	Operates automatically and continually measures the input signal to determine overall level, spectrum of the signal, type of signal (speech, noise, music, etc.), and also the azimuth. The algorithm controls features to automatically optimize processing for a given input signal. This classification process is used to control gain and output, and to trigger different types of noise reduction, directional microphones, or beam forming technologies.
Amplitude expansion	Confusing name, as practically, it reduces the amplitude rather than expands it. Expansion compresses low-level signals, typically background noise, to minimize annoyance from amplified microphone noise and low-level environmental sounds. Allows the patient to use the gain necessary to make soft speech audible without negative background noise side effects.
Basic noise reduction	Based on the modulations of the input signal, it reduces overall gain for a given channel when noise is the dominant signal in that channel. Does not improve the SNR directly, as gain is reduced for everything (including speech), but it reduces annoyance and creates more relaxed listening, making daylong listening less fatiguing.

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Impulse noise reduction	All incoming signals are analyzed, searching for any spectrum that has a very rapid rise time. When this is detected, the signal is dampened. The effect to the user is a less harsh, smoother signal. Not designed for SNR improvement, but for relaxed listening.
Reverberation reduction	Algorithm examines the timing and repetitions of a given waveform within a few seconds, and when the waveform is repeated (reverberation), the gain of the repetitions is significantly reduced. This causes sharp echoes
Wind noise reduction	Nearly all hearing aids have two microphone ports. Wind creates a unique turbulence at the ports that is very unique. When this is detected, and the wind noise feature is activated, the hearing aids will automatically reduce gain in the low frequencies. For some products, the hearing aids will determine which side of the head has the least wind noise, and automatically transfer that cleaner signal to the other hearing aid.
Automatic feedback reduction	This feature first detects any *acoustic feedback* or "whistling" and then reduces or eliminates the problem through phase cancellation. This is accomplished by introducing an out-of-phase signal, the same frequency as the feedback. Feature can increase "useable" gain by 10 dB or more.

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