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A new approach to electric-acoustic stimulation

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When low-frequency acoustic stimulation is combined with either real or simulated electric stimulation from a cochlear implant (electric-acoustic stimulation, or EAS), speech intelligibility in noise can improve dramatically. This improvement has been shown in simulation to be due in part to the presence of fundamental frequency (F0) and amplitude envelope information in the low-frequency region. The current experiment extends those findings to implant patients. Six patients who had residual low-frequency hearing in either their implanted or unimplanted ear participated. A target talker was combined with multi-talker babble and presented to the implant. In the low-frequency region, patients heard either no stimulus, target speech, or a tone that was modulated in frequency to track the dynamic changes in F0, and in amplitude with the amplitude envelope of the low-pass target speech. Results showed that the tone provided, on average, about 58 percentage points of improvement over electric-only stimulation. Both the tone and target speech provided a statistically significant benefit over electric stimulation only ($p<.0001$), and were statistically equivalent to each other ($p>.05$). These results demonstrate that a tone that conveys F0 and amplitude envelope information can provide significant benefit in EAS.