Title: Contralateral speech interference in cochlear-implant users worsens with age: Neural plasticity or attention?

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Many cochlear-implant (CI) users experience a prolonged period (months to years) of speech understanding improvement. Neuroplasticity and relearning degraded frequency-shifted speech sounds are thought to contribute to this adaptation period. In recent years, increasing numbers of CI users have auditory input in both ears, which helps with understanding speech in background noise. Little is known, however, about how the binaural processing of speech occurs for these listeners. Of particular importance is how aging, neural plasticity, and cognition may play a role in the improvement of unilateral and bilateral speech understanding after activation.

A series of studies examined the binaural processing of speech in listeners, who had a wide range of ages (35-80 yrs). They had bilateral (BI)-CIs (i.e., CIs in both ears) or single-sided-deafness (SSD)-CIs (i.e., a CI in one ear and normal-hearing in the other). Binaural processing was evaluated using a contralateral-unmasking paradigm. In the monaural condition, target and interfering speech were presented to one ear. In the bilateral condition, a copy of the interfering speech was also presented to the other ear. BI-CI and SSD-CI listeners can show an increase (unmasking) or decrease (interference) in speech understanding for the bilateral condition, which appears to depend on individual's hearing history and stimulus configuration. This is in contrast to normal-hearing listeners, where the addition of the interferer to the contralateral ear always produces unmasking.

The results revealed tremendous differences across listener groups and individuals. Unmasking was most likely to occur when the target speech was presented to an acoustic or electric ear with good monaural intelligibility. Interference was most likely to occur when the target ear had relatively poor monaural intelligibility or the contralateral ear had a high monaural intelligibility. Critically, there was a strong correlation between CI listener age and the magnitude of the interference. This suggests that there are possible age-related changes in the brain's ability to relearn degraded speech. An alternative explanation is that an age-related reduction in attentional control could result in an inability to ignore the better-hearing ear.

In conclusion, younger CI listeners appear to benefit more from having two inputs to better understand speech in background noise, while older CI listeners appear to be more susceptible to interference effects. CI listeners might benefit from targeted rehabilitation approaches aimed at improving performance in the poorer ear, thereby improving the strength of the weaker pathway and enhancing the ability to selectively attend to an ear.

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