Abstract

Hypothesis: We hypothesized that children with cochlear implants (CIs) who demonstrate cross-modal reorganization by vision also demonstrate cross-modal reorganization by somatosensation, and that these processes are interrelated and impact speech perception.

Background: Cross-modal reorganization, which occurs when a deprived sensory modality's cortical resources are recruited by other intact modalities, has been proposed as a source of variability underlying speech perception in deaf children with CIs. Visual and somatosensory cross-modal reorganization of auditory cortex have been documented separately in CI children, but reorganization in these modalities has not been documented within the same subjects. Our goal was to examine the relationship between cross-modal reorganization from both visual and somatosensory modalities within a single group of CI children.

Methods: We analyzed high-density EEG responses to visual and somatosensory stimuli and current density reconstruction (CDR) of brain activity sources. Speech perception in noise testing was performed. CDR patterns were analyzed within the entire subject group and across groups of CI children exhibiting good vs. poor speech perception.

Results: Positive correlations between visual and somatosensory cross-modal reorganization suggested that neuroplasticity in different sensory systems may be interrelated. Further, CI children with good speech perception did not show recruitment of frontal or auditory cortices during visual processing, unlike CI children with poor speech perception.

Conclusion: Our results reflect changes in cortical resource allocation in pediatric CI users. Cross-modal recruitment of auditory and frontal cortices by vision, and cross-modal reorganization of auditory cortex by somatosensation, may underlie variability in speech and language outcomes in CI children.

Keywords: cross-modal reorganization; vision; somatosensation; auditory; high-density EEG; speech perception; cochlear implant; pediatric