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# Neural speech tracking in young cochlear implanted adults

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Language acquisition depends on critical periods in early ontogeny when the brain is especially sensitive to linguistic input. For typically hearing children, auditory exposure during this time supports the development of the neural systems underpinning speech perception and comprehension. In cases of congenital deafness, although hearing can be restored through cochlear implantation, this typically occurs, at the earliest, after one year of age. This study investigated whether young adults who were congenitally deaf but received early cochlear implants exhibit neural processing of naturalistic speech similar to that of their typically hearing peers. We recorded EEG data from two homogeneous, age- and education-matched groups: 12 early-implanted CI users (mean implantation age: 1 year, 10 months) and 12 typically hearing controls. Participants listened to short stories presented as audio-only (A) or audiovisual (AV) and answered comprehension questions.

At the single participant level, we computed Temporal Response Functions (TRFs) to assess neural synchronization with the speech envelope. Both groups showed clear TRFs in response to A and AV speech envelope. For both groups neural tracking was facilitated in the AV compared to the A condition ($p_{cluster} < 0.05$). However, the CI group exhibited enhanced TRFs amplitude possibly suggesting greater neural tracking effort. Coherently, the CI group had lower comprehension scores compared to hearing controls.

These findings suggest that early-implanted CI users can develop neural speech tracking that closely resembles that of their hearing peers. However, they also highlight the impact of hearing deprivation in early ontogeny, both at the neural and behavioral level.

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No

**Primary author:** COLLESEI, francesca (IMT School for Advanced Studies Lucca)

**Co-authors:** Ms IOB, Erica (IMT School for Advanced Studies, Lucca); Ms FEDERICI, Alessandra (IMT School for Advanced Studies Lucca); Ms FANTONI, Marta (IMT School for Advanced Studies, Lucca; IRCCS materno infantile Burlo Garofolo, Trieste); Mr BOTTARI, Davide (IMT School for Advanced Studies, Lucca)

**Presenter:** COLLESEI, francesca (IMT School for Advanced Studies Lucca)

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