Study shows significant language progress after two cochlear implants

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(Medical Xpress) -- An ongoing study of 45 deaf children who had two cochlear implants finds that their language skills are within the normal range. Cochlear implants replace the eardrum by delivering an electric signal from a microphone to the auditory nerves located in the cochlea in the inner ear.

The study, the first good evidence that a second implant helps with understanding speech, was presented at a Midwestern meeting of experts on cochlear implants held at the Waisman Center at the University of Wisconsin-Madison.

"It's a huge success to see these children making such strides in language acquisition," says Christi Hess, a Ph.D. student in communicative disorders. "Many, after as little as one or two years with the implant, have language scores within the normal range, especially those who got the implant before age two."

Thousands of children get cochlear implants each year, and the surgery is done at an ever-younger age, says Ruth Litovsky, professor of communicative disorders and surgery/otolaryngology.

It's known that implants made at a younger age deliver results more quickly, and that a second implant helps children both locate the source of a sound and understand speech in a noisy room. But until now, it was not clear if the second implant would improve understanding of spoken language.

"The most exciting finding is that having two implants does correlate with an improvement in receptive language," says Hess.

"Many of these children go through an 'Aha!' moment, a revelation, when the inputs they are trying to process suddenly start to make sense," says Hess. "They have not had a framework for organizing these stimuli, but at some point, their brains start to make new connections and they begin to understand the auditory world."

There are several reasons why two implants could be better, says Litovsky, who is director of the binaural hearing and speech lab at the Waisman Center and has studied cochlear implants for 12 years.

"As good as cochlear implants are, they provide input that is degraded, and the input to each ear is imperfect. The hypothesis is that with two implants, the children receive 'two looks' at a signal. The success of surgery in the two ears can vary, so the electrical impulses reaching the brain from each ear are not identical, and getting a signal to both ears gives another opportunity to sample and understand the auditory world," Litovsky says.

The children, who ranged from 4 to 9 years of age at the time of testing, had had at least one year of experience with the first implant and got the second implant by age 6.

There are several reasons to study language acquisition in children with "electric hearing," Litovsky says. "This helps us understand the incredibly complex process of converting pressure waves in the air into sound and then into meaningful information, but this kind of research also helps parents make momentous decision about implants for their children who are deaf."

The surgery is covered by Medicare, but parents must decide whether

and when to implant and whether to do both ears. Understanding the possible benefit of a second implant becomes a critical component of the decision process.

Implants deliver a highly simplified signal — they condense the tens of thousands of frequency information "channels" available in an acoustic system to approximately 20 channels of frequency. That, combined with the consequences of having spent months or years in silence, can limit the benefits. "The children we test are typically functioning fairly well in quiet, everyday conversation," says Hess. "There may be nuances that they are missing, and they tend to have more trouble in the presence of background noise, like what they would hear in a classroom."

Although Hess and Litovsky have seen wide variations in the language skills of the 45 children, Litovsky says it's critical to keep the context in mind. "Without these implants, they would have significantly less ability for spoken and receptive language, or perhaps none at all."

These results reported today came from the first language tests after the children were implanted, but the scientists are continuing to track the 45 children, who came from across the country.

"We are interested in understanding how they will perform over time," says Hess. "Most children have been to the lab for two or three annual visits, and we will soon know more about whether their language tests correlate with auditory measures, whether they continue to improve with added experience with two implants."

Provided by University of Wisconsin-Madison

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