Imbalanced hearing is more than a mild disability

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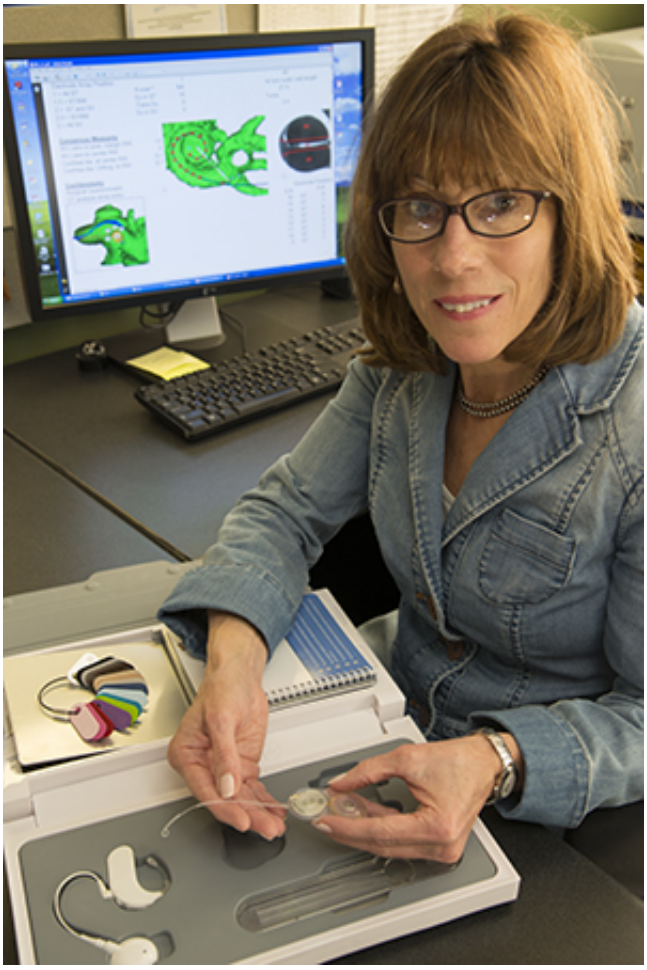

Researchers at Washington University School of Medicine in St. Louis have received a five-year, $3 million grant from the National Institutes of Health to study the effects of asymmetric hearing loss in adults and children. Jill B. Firszt, Ph.D., holds a cochlear implant. She is investigating whether the implant will help patients with notable differences between each ear's ability to detect and process sound. The screen in the background shows an image of a cochlea

(green) with the implant after a patient's surgery. Credit: Robert Boston

Researchers at Washington University School of Medicine in St. Louis have received a five-year, $3 million grant from the National Institutes of Health (NIH) to study the effects of asymmetric hearing loss in adults and children.

Asymmetric hearing is a difference between the two ears' ability to detect and process sound. New studies indicate that people with asymmetric hearing experience greater communication difficulties than previously assumed.

"We have two ears for a reason," said Jill B. Firszt, PhD, associate professor, audiologist and director of the Cochlear Implant Program in the Department of Otolaryngology at the School of Medicine. "A common assumption was that hearing loss in just one ear was minimally disabling. However, our studies and those of others show that listening with just one ear seriously degrades signal segregation and communication, resulting in diminished quality of life."

Firszt's new grant enables continuation of in-depth studies that began in 2008. Patients in these studies have imbalanced hearing in which one ear is deaf and the other ear has varying levels of hearing (from normal to hearing loss augmented with a hearing aid or cochlear implant). Firszt and colleagues showed that individuals who had normal hearing in one ear and deafness in the opposite ear perceived their hearing difficulties to be as disabling as those who had one hearing aid or one cochlear implant and deafness in the opposite ear. In other words, patients viewed many of their listening situations as equally difficult regardless of the mode of hearing in the better ear.

According to Firszt, with two equally functioning ears, the brain can use subtle differences in timing and sound intensity between the two ears to identify sound direction and distance from the listener and to understand speech better in the presence of background noise.

But with asymmetric hearing, it is difficult for people to discriminate voices they want to hear from background noise in restaurants, for example, or to sense the relative distance from one's position in traffic to an emergency vehicle's siren.

Firszt said that very little is known about the effect of asymmetric hearing when it occurs during childhood or is present at birth. Imbalanced hearing from early childhood may have developmental effects that differ from those experienced by an adult who has later onset of profound hearing loss in one ear.

She said that all "unilateral listeners," particularly in adverse listening conditions, may draw upon cognitive resources in certain brain regions more dynamically than normal hearing listeners.

Through neuroimaging, Firszt hopes to define changes in the brain that accompany unilateral hearing loss as well as to better understand the extra effort required of unilateral listeners.

"We know that the brain copes with asymmetric hearing by reorganizing over time," she said. "We want to learn where and how quickly that reorganization occurs and how it impacts successful outcomes when hearing is restored years later through cochlear implants."

At Washington University, Firszt has observed substantial improvement in speech recognition and other benefits from studies in which a cochlear implant was fitted to the deaf ear and a hearing aid continued to be used at the better ear of patients whose asymmetric hearing loss

occurred in adulthood. However, for patients whose asymmetric hearing loss occurred in childhood, before speech and language were learned, outcomes have been reduced.

The new studies will attempt to better define the critical time period for restoring hearing when the loss is unilateral and to identify patients who will benefit most from the procedure.

In the United States, adult patients who have severe to profound hearing loss in one ear and normal hearing in the other have not been traditionally considered candidates for a cochlear implant, although this treatment has been approved in Europe.

Firszt and colleagues are participating in a clinical trial of this treatment. Washington University is one of four U.S. sites that will enroll individuals with adult-onset hearing loss in one ear whose other ear has normal to near normal hearing to assess the effectiveness of a cochlear implant in the non-hearing ear. Data from the initial feasibility study may become the basis for a larger study to potentially gain approval for the procedure from the Food and Drug Administration.

"The trial and our grant-funded studies are aimed at discovering how to achieve the best possible outcomes for patients with asymmetric hearing," said Firszt. "The auditory system is designed to be binaural – to receive input from both ears. It is a highly interactive system rather than two independently operating ears. The system as a whole should be the focus of treatment; what happens to an individual ear affects that system. We now believe that restoring each individual ear's hearing to the feasible extent, and doing so as soon as possible, may be the best course for treating the system."

Provided by Washington University School of Medicine