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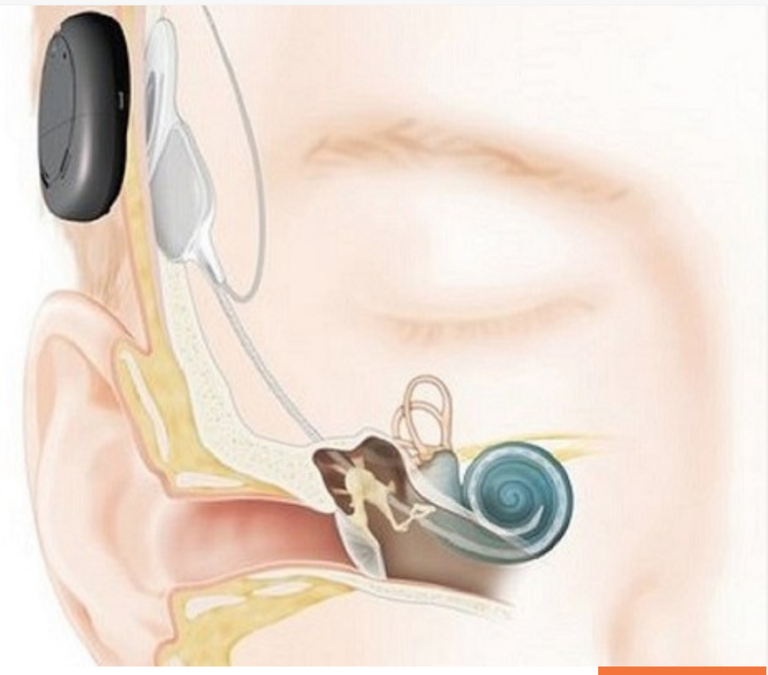

Biomedical, COE, Research

New Technique to Reduce Inner-Ear Trauma During Cochlear Implant Surgery

A $434,000 grant from medical device maker Cochlear Limited will fund preclinical study

Not all patients who receive cochlear implants to treat deafness are totally without hearing; many have some residual hearing. But the inner-ear surgery required to implant these life-changing devices can often result in trauma that causes loss of that residual hearing. Suhrud M. Rajguru, an assistant professor in the University of Miami College of Engineering's Biomedical Engineering Department and the director of Sensory Electrophysiology Laboratory at the Miller School of Medicine's Department of Otolaryngology, is testing a device that he believes will reduce the inner-ear trauma and preserve residual hearing following cochlear implant surgery. The patented device, designed by Dr. Rajguru in collaboration with Lucent Medical Systems (Kirkland, Washington) induces a mild to moderate, localized hypothermia in the cochlea before surgical insertion of the implant, lowering its temperature by 4 to 6 degrees Celsius.

Rajguru hypothesizes that inducing local hypothermia in the inner ear prior to surgery will mute the ear's response to the trauma of surgery. This trauma can lead to inflammation of the inner ear, as well as oxidative stress – essentially, an imbalance between the production of damaging free radicals and the body's ability to counteract their harmful effects. Inflammation and oxidative stress can lead to neural degeneration, loss of hair cells in the ears and a loss of residual hearing. Inducing hypothermia may significantly reduce inflammation and oxidative stress, and therefore reduce damage to the inner ear. The device that Rajguru has developed does not require any modifications to current cochlear implant surgery methods.

"Our approach of inducing localized hypothermia prior to trauma and during the surgical procedure has the potential to become the standard of care in cochlear implant patients," Rajguru says. He is conducting the research with Cochlear Limited, which develops and manufactures cochlear implants and has given him a $434,000, three-year grant.

Preserving a patient's residual hearing is increasingly important as doctors perform more cochlear implant surgeries on patients with residual hearing. With an implant, these patients are able to hear via both electrical stimulation from their implant and acoustic stimulation from their residual hearing, which is known as bimodal electroacoustic stimulation (EAS). By combining these two ways of hearing, patients are able to recognize speech better, listen to speech through background noise and appreciate music.

"Residual hearing is important for everybody with a hearing loss; it represents hearing potential," explains Fred F. Telischi, MD, professor and James R. Chandler Chair of Otolaryngology at the Miller School of Medicine. "Any existing residual hearing supports the sounds that are stimulated by the cochlear implant, increasing the importance of preserving residual hearing in patients undergoing cochlear implant surgery."

Preserving residual hearing and reducing trauma is even more important when the patient is a child, especially because it can be difficult to determine a young child's residual hearing levels. If residual hearing can be maintained, children with cochlear implants are able to learn better and to recognize sounds more effectively. FDA-approved indications allow cochlear implants in both ears for young children who have residual hearing.

Experiments in rats have suggested that localized hypothermia can preserve significant hearing after cochlear implantation. Working with Cochlear Limited, Rajguru and his team will carry out controlled experiments to further advance the technology. "These experiments will guide development of a future application of hypothermia to improve patients' long-term results following cochlear implant surgery," Rajaguru says.

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