

Tripler Army Medical Center

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When silence is not golden

Cochlear implant surgery offers hearing-impaired the gift of a lifetime

(Editor's Note: The listing of websites in this release and the appearance of information, products or services on these websites do not constitute endorsement by Tripler Army Medical Center, Pacific Regional Medical Command, the Department of the Army, the Department of Defense, or the U.S. Government, of the information, products, or services contained therein.)

by **Les Ozawa**

Tripler Army Medical Center Public Affairs Office

HONOLULU—"The 'Aha!' moment for me with Makayla Houston came when she was heading for the double doors to leave," said Susan Grau, Tripler Army Medical Center's pediatric speech therapist.

"I was behind her and said, 'Push!' Dr. Ramsey just happened to be walking down the hallway when she said, 'Tush!'"

"Dr. Ramsey said, 'She heard you! She wasn't looking and she heard you!' Makayla had understood and came back with her version of the same word," said Grau.

That was just one hurdle, but a very significant one, for the then three-year-old, strong-willed toddler, in her journey towards learning speech as a means of communication. Grau renewed her efforts to go over dozens of sounds and carefully selected words with Makayla, teaching her to control the movement of her breath and parts of her mouth and throat, and to correctly imitate and reproduce the speech sounds she heard.

For centuries, deaf people have developed a separate, but rich cultural space in which to live with the rest of society. They have developed their own ways of communicating to others, through signing, lip-reading and other silent cues.

Technology developed in the 1980's, however, has aided tens of thousands of people who could not be helped with conventional hearing aids. "Cochlear implants have brought hope to many people who are hard-of-hearing or deaf," said Maj. (Dr.) Mitchell Ramsey, co-director of Tripler's cochlear implant program.

"At first, people thought this would never work," said Ramsey. "Through a number of different engineering advances, auditory research, safety trials and most importantly, working with patients, cochlear implants have become a large success."

The technology has taken off, according to the Tripler otologist (ear specialist). While cochlear implants (CI) are still relatively rare in Hawaii, their use has expanded widely in the rest of the nation, and in Europe and Asia. In 1994, there were approximately 6,000 CI users worldwide. Today there are about 60,000 users.

"It's widely accepted as the medical standard of care for patients with severe to profound hearing loss, who don't benefit from hearing aids but who choose aural/oral communication," said Ramsey. The procedure, first approved by the FDA in 1985, is covered by most medical insurance, including Medicare and TRICARE. In 1999, the FDA approved the surgery for children as young as one year old.

While the surgery itself runs in the tens of thousands of dollars, cost-effectiveness is not an issue. A Johns Hopkins University study compared this procedure to other surgeries like knee replacement and pacemaker. The study looked at lost income and quality of life. Other studies have looked at the cost savings of mainstreaming hearing-impaired students into regular schools. "Cochlear implants are one of the best medical values available," said Ramsey.

In the past two years, Ramsey has performed nine implant surgeries on adults as well as on young children. While his practice is limited to Department of Defense (DoD) beneficiaries, a former Tripler pediatric otolaryngologist, Dr. Lenhanh Tran, has recently started a CI program at Kapiolani Medical Center for Women and Children in Honolulu.

The surgery is technically challenging, performed almost entirely under a microscope. However, selection and rehabilitation are the most critical aspects to the overall success of the program, especially for young children. CI users have to work hard at linking meaning with sounds. A coordinated effort between the state's Department of Education (DOE) and Department of Health, and the medical providers is needed to ensure success.

Tripler has found its team approach successful in treating CI patients. The team consists of program co-directors Ramsey and audiology chief Amy Hines, speech therapists, a psychiatrist, and social workers. For children attending public schools, the team includes DOE special education specialists. The team meets monthly to discuss the status of all patients and ways to improve their progress.

To help CI users and their families, Tripler Army Medical Center recently helped start a support group for CI users, their parents and other family members, and professionals working with CI users. For more information, contact Suzanne Leclaire at 433-3206, suzanne.leclaire@amedd.army.mil.

Q's and A's about Cochlear Implants

Who are successful Cochlear Implant (CI) candidates?

ong Adults and Older Children

- Must have severe to profound hearing loss in both ears
- Hearing aids must provide little or no benefit
- Must be healthy enough to tolerate the surgery
- Must have clear understanding of its benefits and limitations
- Must be motivated to commit the time for pre-surgery evaluations and post-surgery follow-up services

ong Younger Children

- Parents of toddlers must understand the surgery's benefits and limitations
- Parents must be motivated to commit their and their child's time for pre-surgery and post-surgery services, including years of special training at home, clinic visits, and school programs

does a person normally hear?

The human ear consists of many parts that convert sound vibrations into electrical signals understood by the brain. In a normal ear, sounds go in the ear and vibrate the eardrum. The eardrum passes the vibrations to the inner ear, where three small bones conduct the vibrations into the cochlea.

The cochlea consists of a chamber filled with 16,000 hair cells floating in a fluid. The sound vibrations cause the cochlea's fluid and hair cells to move. The cochlea's thousands of hair cells vibrate at the many frequencies of sound, allowing a person with normal hearing to hear a sound's richness, including its loudness, pitch, and "color." The hair cells then generate electrical impulses in the auditory nerve that travel to the area of the brain that recognizes them as the sound of raindrops, spoken words, etc.

Hearing loss involves damage to any of the vital ear organs, including the eardrum and the three small ear bones. Damage to the inner ear, or cochlea, however, is the most common cause of hearing loss. If the cochlea is damaged to a large enough degree, conventional hearing aids are of little help.

Today's cochlear implants use up to 22 channels on computer chips to transmit sound signals to the auditory nerve. It's not as sensitive as the 16,000 hair cells, but accurate enough to allow thousands of people to carry on phone conversations, enjoy concerts, and react to everyday sounds like someone's footsteps. Over half of implant users recognize speech without lip-reading.

does a cochlear implant work?

In a normal ear, sounds travel through the eardrum to the cochlea's hair cells. A CI bypasses that route. Its implanted electrodes send signals directly to the auditory nerve endings in the cochlea.

The device usually has three main pieces:

- a tiny receiver coil that goes under the skin behind the ear, with connecting electrodes on a wire that is threaded to the cochlea
- an easily removable external headpiece (consisting of a microphone and wireless transmitter) placed directly over the imbedded receiver coil and held in place by a weak magnet
- a sound processor, usually worn on a belt or in a pocket, connected by a wire to the headpiece

The sound processor converts sounds received by the headpiece's microphone into distinctive electrical signals that are sent back to the headpiece, where its transmitter sends the signals through the electrodes to the auditory nerve in the inner ear.

What does cochlear implant surgery involve?

CI surgery carries the normal risks of major ear surgery requiring general anesthesia. The surgeon cuts a small flap in the skin behind one ear to drill a hole in the bone to access the inner ear. A wire is threaded into the inner ear and its receiver coil is set in the bone behind the ear. The surgeon then sutures back on the skin flap. Most patients spend the night in the hospital and are discharged the next day.

People with hearing loss differ in what frequencies they cannot hear. After the device is activated, it must be "tuned" or adjusted to that person's needs and comfort, somewhat like an equalizer on a high-end home entertainment sound system. Older children and adults learn how to adjust the processors themselves during therapy.

How much benefit can a person get from a cochlear implant?

It depends on:

- How long a person has been deaf. People who become deaf after they have already learned how to speak seem to benefit more than others.
- Those born deaf benefit more, if they receive the implant sooner than later
- The number of surviving auditory nerve fibers
- The implanted person's motivation to learn to hear

Website Resources

Much information about cochlear implant surgery is available at various websites. Listed below are a

few. On the last site below, you can listen to what a cochlear implant patient would “hear” through the device.

http://www.agbell.org/information/brochures_adults_cochlear.cfm

<http://www.entnet.org/healthinfo/ears/cochlear-implant.cfm>

<http://www.hearinglossweb.com/index.htm>

www.rushu.rush.edu/cds/arl/DEMOS/CIwebdemo

by Les Ozawa

Sgt. Jason Houston (from left) goes over flashcards with his daughter, Makayla, to help her practice speech sounds, while she is coached by her mother, Jessica, during a speech therapy session at Tripler Army Medical Center. The Houstons, formerly of Wahiawa, recently moved to Charleston, S.C.

by Les Ozawa

Cheyune Glover (left) of Honolulu tends to her newly born son, Alonzo, as Tripler Army Medical Center's medical instrument technician Joyce Parkhurst checks the results of his hearing test. State law requires all newborn infants be given the test.

by Les Ozawa

Tripler Army Medical Center speech therapist Susan Grau (from left) works with Reina Larson while her mother, Tonya, of Pearl City looks on. Reina, born deaf, recently underwent surgery to receive a cochlear implant.