Now hear this: 3-D imaging technology could lead to hearing aids that fit better

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Hearing aids work best when there is a tight seal between the device and the wearer’s ear canal.

(PhysOrg.com) -- About 36 million Americans suffer from some type of hearing loss. However, only one in five who could benefit from a hearing aid actually wears one, according to the National Institute on Deafness and other Communication Disorders. MIT engineers believe that number could be boosted if there were a better way to fit hearing aids to the wearers' ears.

Getting useful sound amplification from a hearing aid depends on a tight fit between hearing aid and ear canal, but the current method of modeling patients’ ears is messy and not always accurate, potentially leading to a device that fits poorly and offers little benefit.

“A lot of people with hearing aids are likely walking around with hearing aids that don’t fit, because they don’t know what they’re supposed to feel like,” says Douglas Hart, MIT professor of mechanical engineering.

Hart has patented a new way of scanning the ear canal with 3-D imaging technology — a process that is much faster, easier and more accurate than the plaster-mold technique. He plans to market the technology to hearing-aid manufacturers first, but believes it could also be useful to build fitted earphones for MP3 music players, or custom-fit earplugs for military personnel and other people who work in noisy environments.

3-D scanning

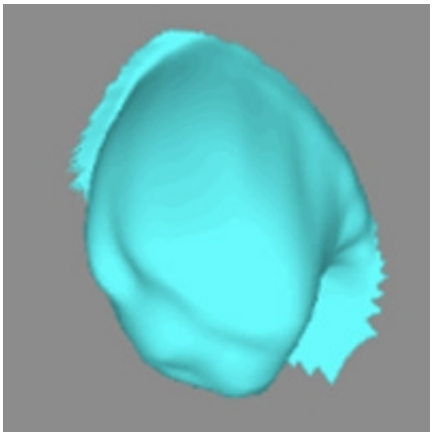
The new technology is similar to a recently commercialized 3-D scanning system that Hart developed for dentistry, designed to replace the silicone molds traditionally used to make impressions for dental crowns and bridges. While Hart was working on that imaging system, hearing-aid manufacturers approached him to see what he could do to improve their fitting process.

Getting a precise 3-D scan of the ear canal is the “Holy Grail of the hearing aid industry,” says Scott Witt, head of research and development for hearing-aid manufacturer Phonak. “Taking these impressions is still the messiest, least exact part of the process,” he says.

Patients who need a hearing aid usually have to spend about an hour with an audiologist, who fills the patient’s ear canal with a gooey silicone substance. After about 15 minutes, the gel hardens into a mold that is removed from the ear and shipped to a hearing-aid manufacturer, who scans the mold and builds a custom-fit hearing aid using a 3-D printer.

With this method, it can be difficult to achieve a tight seal between the hearing aid and the patient’s ear canal. A tight seal is necessary to

prevent feedback between the microphone and receiver, which can produce squealing sounds annoying to the wearer and anyone standing nearby.



This three-dimensional scan of the ear canal, taken with new imaging technology developed at MIT, could be used to manufacture better fitting hearing aids. Image: Federico Frigerio

With the new MIT system, a very stretchy, balloon-like membrane is inserted into the ear canal and inflated to take the shape of the canal. The membrane is filled with a fluorescent dye that can be imaged with a tiny fiber-optic camera inside the balloon. Scanning the canal takes only a few seconds, and the entire fitting process takes only a minute or two.

Witt believes the MIT scanner has more potential than any other proposed imaging system he has seen in the past several years. “What really interested me is, they say they can determine the physical properties of the ear canal, such as how soft the tissue is,” he says.

Because the camera captures 3-D images so quickly, it can measure how much the surface of the ear canal deforms when the pressure changes, or

how the canal shape changes when the wearer chews or talks. That could help hearing-aid manufacturers design devices that keep their tight seal in those situations.

The higher accuracy of digital scans could also eliminate the need for repeated impressions. “So many times we get impressions and have to go back (to the audiologist) and say, ‘We can’t really use this,’” says Witt.

The Deshpande Center for Technological Innovation funded the development of the new technology, which Hart described in a 2004 article in the journal Applied Optics. He patented the system in January and has founded a company in the hope of bringing the innovation to market.

The researchers have built a prototype scanner to demonstrate the proof of concept, and are now working on a handheld version of the device. Once it’s ready, they plan to do a study comparing the fit of hearing aids built with the new scanner to that of traditional hearing aids.

The new technology could be seamlessly integrated into existing manufacturing practices, says Witt. “We could do it right now. The rest of our manufacturing process is set up to receive digital scans,” he says.

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