Medical Xpress

Paralyzed patient moves prosthetic arm with her mind

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Experimental robotic technology may also someday help people with amputations as well, experts hope.

(HealthDay)—It sounds like science fiction, but researchers are gaining ground in developing mind-controlled robotic arms that could give people with paralysis or amputated limbs more independence.

The technology, known as brain-computer (or brain-machine) interface, is in its infancy as far as human use—though scientists have been studying the concept for years. But experts say that people with paralysis or amputations could be using the technology at home within the next decade.

It basically boils down to people using their thoughts to control a robot arm that then performs a desired task, like grasping and moving a cup.

That's done via tiny electrode "grids" implanted in the brain that read the movement signals firing from individual nerve cells, then translate them to the robot arm.

"We have the ability to capture information from the brain and use it to control the robotic arm," said Dr. Elizabeth Tyler-Kabara, who presented her team's latest findings on the technology Tuesday, at the annual meeting of the American Association of Neurological Surgeons, in New Orleans.

However, she stressed, "we still have a ton to learn."

Right now, the robot arm is confined to the lab. After getting their electrodes implanted, study patients come to the lab to work with the robotic limb under the researchers' supervision. So far, Tyler-Kabara and her colleagues at the University of Pittsburgh School of Medicine have tested the approach in one patient. Researchers at Brown University in Providence, R.I., have done it in a handful of others.

One of the big questions, Tyler-Kabara said, is "how much control is enough?" That is, how well does the mind-controlled arm need to work to bring real everyday benefits to people?

At the meeting on Tuesday, Tyler-Kabara presented an update on how her team's patient is faring. The 53-year-old woman had long-standing quadriplegia due to a disease called spinocerebellar degeneration—where, for unknown reasons, the connections between the brain and muscles slowly deteriorate.

Tyler-Kabara performed the surgery, where two tiny electrode grids were placed in the area of the brain that would normally control the movement of the right hand and arm. The electrode points penetrate the brain's surface by about one-sixteenth of an inch.

"The idea is pretty scary," Tyler-Kabara acknowledged. But her team's patient had no complications from the surgery and left the hospital the next day. There've been no longer-term problems either, she said—though, in theory, there would be concerns about infection or bleeding over the long haul.

The surgery left the patient with two terminals that protrude through her skull. The researchers used those to connect the implanted electrodes to a computer, where they could see brain cells firing when the patient thought about moving her hand.

She was quickly able to master simple movements with the robotic arm, like high-fiving the researchers. And after six months, she was performing "10-degrees-of-freedom" movements, Tyler-Kabara reported at the meeting.

That includes not only moving the arm, but also flexing and rotating the wrist, grasping objects and affecting several different hand "postures." She has accomplished feats like feeding herself chocolate.

The researchers initially used a computer in training sessions with the patient, but after that the robot arm is directly linked to the electrodes—so there is no need for "computer assistance," according to Tyler-Kabara.

Still, before the technology can ultimately be used at home, she said, researchers have to devise a "fully implanted" wireless system for controlling the robot arm.

Another expert talked about the new technology.

"This is one more encouraging step toward developing something practical that people can use in their daily lives," said Dr. Robert

Grossman, a neurosurgeon at Methodist Neurological Institute in Houston, who was not involved in the research.

It's hard to put a time line on it all, Grossman said, since technological advances could changes things. He also noted that several research groups are looking at different approaches to brain-computer interfaces.

One, Grossman said, is to do it noninvasively, through electrodes placed on the scalp.

Study author Tyler-Kabara said that noninvasive approach has met with success in helping people perform simple tasks, like moving a cursor on a computer screen. "But I don't think it will ever be good enough for performing complicated tasks," she said, noting that it can't work as precisely as the implanted electrodes.

A next step, Tyler-Kabara said, is to develop a "two-way" electrode system that stimulates the brain to generate sensation—with the aim of helping people adjust the robot's grip strength.

She said there is also much to learn about which people will ultimately be good candidates for the technology. There may, for example, be some brain injuries that prevent people from benefiting.

Because this study was presented at a medical meeting, the data and conclusions should be viewed as preliminary until published in a peer-reviewed journal.

The research is being funded by the U.S. National Institutes of Health, the Department of Veterans Affairs and the University of Pittsburgh.

More information: The University of Pittsburgh has images of the brain-computer interface at work.