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## With a little ‘tickle,’ a new technology gives hope to stroke patients with paralysis

By Jen Christensen, CNN

(CNN) — For nearly a decade, Heather Rendulic hasn't been able to use her left hand to feed herself or pick up something as light as a soup can — but that changed when she became part of a clinical trial that could radically improve the lives of people who've been paralyzed after a stroke.

The results of that trial were published Monday in the journal *Nature Medicine*.

Rendulic has a rare brain disease called cavernous angioma, a blood vessel abnormality that can cause stroke. She had a series of them — five total — over a period of 11 months when she was just 22 years old that left her paralyzed on her left side.

“The most challenging part of my condition is living one-handed in a two-handed world,” the Pittsburgh resident said.

A stroke cuts off the blood supply to the brain, and cells start to die within minutes. A person can have paralysis if the stroke damages the part of the brain that sends messages to trigger muscles to move.

Rendulic eventually regained some function on her left side, but she was still unable to use a fork or make a fist with that hand.

In 2021, as a part of a joint project between the University of Pittsburgh and Carnegie Mellon University, researchers implanted a pair of thin metal electrodes along her neck.

Doctors already use spinal cord stimulation technology to treat persistent pain. Research has shown that the technology could be used to restore leg movement after a spinal cord injury, but hand movements are a little trickier. A hand that functions properly has a unique kind of dexterity and a wide range of motion.

For the trial, scientists implanted electrodes along



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**A research team talks with Heather Rendulic (R) while checking if she can move her arm as she is paralyzed due to a stroke, at UPMC in Pittsburgh.**

the surface of the spinal cord that look like strands of spaghetti. The electrodes give tiny impulses that stimulate specific regions and activate nerve cells inside the spinal cord.

“The sensory nerves from the arm and hand send signals to motor neurons in the spinal cord that control the muscles of the limb,” said study co-author Dr. Douglas Weber, a professor of mechanical engineering at the Neuroscience Institute at Carnegie Mellon University. “By stimulating these sensory nerves, we can amplify the activity of muscles that have been weakened by stroke. Importantly, the patient retains full control of their movements: The stimulation is assistive and strengthens muscle activation only when patients are trying to move.”

This technology could work with a wide range of patients, the researchers said.

Rendulic said the stimulation feels “kind of like a tickle.”

It's never painful, but it takes a little getting used to.

As tiny black plastic boxes light up and flashing green lights travel up and down her arm, the device allows motion that would have been unthinkable years ago.

Even on the first day, she had a new range of movement. She didn't have to be shown how to open the hand or reach the arm, the researchers said. For more complex tasks, a little training was needed.

"When the stimulation is on, I feel like I now have control of my arm and my hand again that I haven't had in over nine years," she said.

Rendulic can lift her arm above her head, use a fork to bring food to her mouth, and fully open and close her fist. The other person participating in the trial had similarly promising results.

At one point during the trial, Rendulic picked up a soup can and released it on a marked spot on a board. The lab around her erupted in cheers, and she pumped her other arm in the air in triumph.

"It's just awesome," she said.

The researchers got another pleasant surprise. "We found that after a few weeks of use, some of these improvements endure when the stimulation is switched off, indicating exciting avenues for the future of stroke therapies," said study co-author Dr. Marco

Capogrosso, an assistant professor of neurological surgery at Pitt.

This means even after the device is removed, with some intense physical training, subjects may have long-term improvements, the researchers said.

No treatments are considered effective for treating paralysis six months or more after a stroke, in what doctors call the chronic stage.

The stimulation technology needs to be tested further, but it has great potential, the researchers said.

And it may fill a growing need. Doctors predict that 1 in every 4 people over the age of 25 will have a stroke in their lifetime, and many will develop some kind of paralysis, according to the World Stroke Organization.

"Creating effective neurorehabilitation solutions for people affected by movement impairment after stroke is becoming ever more urgent," said study co-author Dr. Elvira Pirondini, an assistant professor of physical medicine and rehabilitation at Pitt.

"Even mild deficits resulting from a stroke can isolate people from social and professional lives and become very debilitating, with motor impairments in the arm and hand being especially taxing and impeding simple daily activities, such as writing, eating and getting dressed."