

Therapy To 'Recharge' Stroke Victims' Arms

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WALTER SPRING, 79, of Litchfield, who lost much of the use of the left side of his body after a stroke, works with a robot-assisted device intended to help him learn to use his arm again at the Veterans Hospital in West Haven last month. (MICHAEL KODAS / HARTFORD COURANT / June 9, 2008)

Walter Spring didn't complain much about what he lost when a stroke weakened the left side of his body more than two years ago.

There were the big things: hunting and fishing in the Litchfield hills; riding his motorcycle; tinkering with power tools in his wood shop.

And there were little things: turning the pages of his morning newspaper; washing his back in the shower; clasping his seat belt; putting on his own socks.

Barbara Spring saw her husband's frustration in the silent tears that rolled down his cheeks when he thought nobody was looking. After 46 years of marriage, those tears, more than anything else, broke her heart.

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The hopelessness deepened last summer, when Spring was discharged from physical therapy, his left arm useless, his hand clenched like a claw. The stroke had killed the part of his brain that controlled the arm and hand, he was told. He'd have to learn to live with it.

Then, Spring got hooked up with a robot.

After about three months of exercising with the electronic therapist, Spring, 79, is mowing his lawn again this summer. He's pulling weeds in the garden of his Litchfield home and taking target practice at the local sportsman's club. He can even put on his own right sock and is hopeful that the left will soon follow.

Spring is participating in a clinical trial at the Veterans Hospital in West Haven designed to find out if robot-assisted therapy can restore arm function in stroke victims even many years after the damage has been done.

If it works, the study could turn conventional thinking about stroke treatment on its ear by showing that you actually can teach damaged brain tissue new tricks.

"I was basically taught that once a person has had a stroke in the last one to two years, they weren't going to gain very much [mobility]," said Dr. Albert Lo, chairman of the \$5 million U.S. Department of Veterans Affairs robotics study. "People who have had strokes didn't have much hope for any recovery."

Since the study began about a year ago, Lo said he has seen patients who had strokes 25 years ago find renewed mobility in their arms. Once the study is complete, next summer, researchers expect to know for sure whether performing thousands of repetitive movements with the help of a smart electronic therapist can indeed restore function in limbs that were thought to be dormant.

"We're going to give this the best test possible," Lo said. "If it works, wonderful, but if it's wishful thinking, we want to know that as well."

The robots are being tested in West Haven and VA hospitals in Seattle, Gainesville, Fla., and Baltimore. The study is open to veterans with arm or hand weakness caused by a stroke.

Half of the study participants receive intensive physical therapy with a human therapist three times a week for 12 weeks.

The other half are assigned to the robot group. This is less exciting than it sounds. The robot looks more like a garden-variety brace or splint that is strapped to the wrist, elbow or shoulder, depending on which joint is being used.

A flat-screen computer monitor displays colorful dancing dots a la 1980s video games. Using a joystick, the patient is challenged to hit moving targets on the screen, using the stroke-weakened arm. If the patient cannot move the arm, the machine helps. If the machine senses any movement by the patient, it backs off, letting the injured arm do more of the work.

Even if the patient at first cannot accomplish the task, the very act of thinking that the arm should move, then having it touch the correct target propelled by the robot, starts to restore or rebuild circuits in the brain, said Hermano Igo Krebs, a Massachusetts Institute of Technology-trained mechanical engineer who developed the device known as MIT-Manus.

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"The person sees a target asking them to extend the elbow. If they could move, they would," Krebs said. "The machine helps to make the movement; the impulse goes back to the brain so [the brain and the arm] are firing together."

Although the study data have not yet been analyzed, Drs. Noshene Ranjbar and Daniel Federman, who are running the study in West Haven, said patients in both the robot and the conventional therapy group seem to be showing improvement.

What they hope to show is that the robot offers a cheaper, more effective and more reliable approach to physical therapy for stroke patients. And they would like to convince insurance companies that it is never too late to give stroke patients hope for regaining mobility.

The robot is not designed to replace humans as physical therapists. But it has advantages. A human physical therapist can engage a patient's arm 60 to 80 times in an hour, Krebs said. During that same period, the robot can initiate 1,024 repetitive arm movements without getting bored or tired, Krebs said.

But repetitive movement alone is not enough. In early trials of robotic therapy, scientists strapped a patient's crippled arm to a repetitive movement machine that simply moved the limb while the patient watched TV. There was no improvement. The key to reawakening brain synapses — the little messengers that run back and forth between nerve cells, keeping the lines of communication open — is to think about moving, then have the movement occur. It's the ultimate mind-body connection.

If the theory holds up, the robot-assisted therapy could become another breakthrough in the field of stroke treatment that has only recently been able to offer hope to the estimated 700,000 people in the United States who have strokes every year.

For decades, patients were sent home from the hospital a few days after a stroke with a handshake and a pile of prescriptions to treat the conditions that most frequently lead to strokes — diabetes, high blood pressure, high cholesterol and smoking. Sometimes, they were sent for physical therapy. But if movement did not return after about three months, they were often told to use the other arm and be grateful for what they could do.

"Patients say the loss of arm or hand function is the most disabling aspect of a stroke," said Lo, a neurologist who has moved to Brown University in Providence, but continues to oversee the VA study.

Combined with improvements in emergency care, patients for the first time can begin to hope that a stroke — which can be caused by a blood clot or a burst blood vessel in the brain — may not be devastating.

When a stroke occurs, blood flow to the surrounding tissue is interrupted, causing cell death or damage. The key to recovery, said Dr. Isaac Silverman, co-medical director of the Stroke Center at Hartford Hospital, is to restore blood flow as quickly as possible.

Several promising techniques for protecting the brain are emerging. These include medication, catheterization, medically cooling the body to preserve injured tissue and surgery to relieve pressure on the brain caused by swelling.

But the most fundamental component to better stroke treatment rests in the hands of patients and their families.

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"The area that's most lacking is public awareness," Silverman said. At most community hospitals around the country, only 1 percent to 5 percent of patients arrive at the emergency room within three hours of a stroke — the time window for receiving the only FDA-approved clot-busting drug, t-PA. At regional stroke centers such as Hartford Hospital, 30 percent to 40 percent of patients arrive in time to receive the life-improving drug. But even that's not enough, Silverman said.

"Until it's on par with a heart attack, patients are going to get here late," he said. Patients and families, he said, must realize that stroke symptoms — which can include numbness, dizziness, and trouble speaking — are an emergency and they should call 911.

Ideally, Lo said, he'd like to treat stroke patients in the emergency room and send them home with a prescription for robot-assisted physical therapy that would be covered by insurance, just like the blood thinners the patient also must have.

At the same time, he hopes to have evidence that robot therapy can offer hope to patients such as Walter Spring, whose stroke damage seems more permanent.

Home Use

Because the robots are still in their infancy, they are expensive and available only in clinical settings. But if the experiments show they work, Krebs said he envisions them becoming available for home use. He even imagines that stroke patients may be able to interact in cyberspace by competing against one another, playing therapeutic computer games while their arms are getting stronger.

At Gaylord Hospital in Wallingford, a robot-controlled portable sling is being used to help stroke patients practice activities of daily living such as folding towels, or taking groceries off a store shelf, and other devices are quickly being developed.

Although the VA study will not be completed for more than a year, Barbara Spring said she is already amazed by her husband's progress.

"I was hoping for the slightest little movement to be gained, just opening his fingers in the beginning," she said. "I never dreamed ... her voice trailed off."The other day he was holding a sandwich with both hands."

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