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Splice of Life

Nerve graft surgery is restoring some function and sensation for people with spinal cord injuries.

By Christofer Pierson

Tom Spiegler, 47, a C5-6 quadriplegic who lives in the Hudson Valley north of New York City, was not looking to be cured of the paralysis he acquired in a work-related accident in May of 2006. He just wanted to fix his wrenched hand to be able to hold things without dropping them—things like pens, eating utensils, and ping-pong paddles.

"If I wanted to play ping-pong with my daughter," Spiegler says, "we'd have to duct-tape the paddle to my hand."

Spiegler imagined an operation that would reshape his hands into forms that would actually be functional. So in late October of 2009, he paid a visit to Dr. Andrew Elkwood, a plastic surgeon affiliated with the Plastic Surgery Center in Shrewsbury, New Jersey, who was recommended to him by his physiatrist at the Kessler Rehabilitation Institute in West Orange.

Dr. Elkwood recommended an operation that promised much more function than Spiegler thought possible. If successful, the operation would enable Spiegler to lift and bend his elbow and to move his thumb back and forth in opposition to his fingers—to open and close his grip—at will. Furthermore, Elkwood proposed to accomplish this without functional electric stimulation or other high-technology devices. He would rework the circuitry of Spiegler's own nervous system, bypassing the nerves and cord below the injury that were receiving and sending no signals to or from the brain, and hooking his extremities up to the still-working part of the nervous system above the injury.

The Ideal Candidate

Elkwood, who is chief of the plastic surgery division at Monmouth Medical Center in Long Branch, New Jersey, is a pioneer in the field of nerve grafting for patients with paralysis. "We can't cure spinal cord injury now, but we can help people live better," he says.

"I thought of it first for spinal cord injury," Elkwood continues. "I was just waiting for the right patient to come along."

The ideal candidate, Elkwood says, is someone who is basically healthy, has strong shoulder muscles (which are necessary for moving the arms when a neural pathway is restored), and is not looking for instant gratification. The operation requires six weeks of bed rest, followed by at least six months of waiting for the first signs of success.

"Nothing might happen for a full year as the nerves are regrowing from where the splice occurs," Elkwood says. "We're not talking about an event but a process. You might get a millimeter of nerve growth a day, which amounts to an inch a month. This can be a frustrating period when nothing meaningful seems to be happening. This surgery is definitely not for everyone."

Dr. Andrew Elkwood of the Plastic Surgery Center in Sherwood, New Jersey, is a pioneer of nerve-grafting for people with SCI.

As it happened, Elkwood's first patient did not have SCI but was recovering from a stroke that rendered his left arm paralyzed. In February of 2007, Elkwood and a team of surgeons removed linguini-like nerves from their 47-year-old patient's legs and, after creating a "nerve tunnel" across his chest that connected to a part of the brain not affected by the stroke, spliced them to nerves in his arm.

In February of this year, Elkwood reported that his first patient was now able to lift, move and bend his once paralyzed

arm. "We are extremely pleased with [the] surgery outcome. In addition to improving his quality of life, his results portend significant implications for individuals worldwide that suffer paralysis from a stroke. Given his successful results, we believe there is a great deal more we can do going forward to restore further function of paralysis caused by strokes."

The Operation

Meanwhile, Tom Spiegler had signed up to be the first known quadriplegic to receive Dr. Elkwood's nerve graft surgery on the arms. Was he concerned about the length of time between the surgery and certainty over whether or not it would actually work the way it was supposed to?

"Dr. Elkwood was really good being forward about the risks involved," Spiegler says. "The one thing I had to grapple with was the idea of being laid up in bed for six weeks. When you're disabled, the last thing you want to be is more disabled."

Spiegler confesses that going into the surgery requires a "leap of faith."

"You can't be desperate for results," he says. "You have to be patient. I thought the concept behind the operation made sense. The idea of my muscles working again is very appealing. Even anything at all working would be a lot."

Nerve graft surgery, which lasts about eight and a half hours, requires six weeks bed rest followed by as much as a year of waiting for results.

On the morning of May 7, Spiegler underwent eight and a half hours of surgery at Monmouth Medical Center. Elkwood and his team removed nerve from Spiegler's ankles—leaving intact nerves from other parts of his leg that might be needed if a cure were to develop—and ran electromyogram (EMG) tests to ensure that the "parts" were all in working order before being mechanically repurposed. The nerves were microscopically sutured with glue made from blood clots.

Spiegler was pleased with the surgery. "I was practically an outpatient," he says. "I left the hospital the next day by noon." Although he was prescribed pain medication, he says he didn't need so much in the days following the operation.

And now, he waits.

Reason to Hope

Giving Spiegler reason to hope is another nerve graft surgery that Elkwood performed on a spinal cord injured patient. Tory Cavalieri was a veteran NASCAR and Motocross racer who was injured in a 2004 Motocross accident. For years, Cavalieri suffered a string of pressure sores that often kept him entirely out of commission while waiting for them to heal.

In January 2009, Dr. Elkwood grafted a nerve from Cavalieri's buttocks, bypassing his damaged spinal cord and connecting directly with his cranial nerve. For the first time in five and a half years, Cavalieri reported in February 2010, he was able to sense his posterior muscles, a development that will go a long way toward preventing further pressure sores in the future.

If Spiegler sees some changes like Elkwood's other patients have seen next year, he will consider undertaking another surgery for his other arm. "I'm just looking for more independence," he says.

For further information about nerve graft surgery possible for people with SCI, please visit **www.advancedreconstruction.com**, or call 866-BODY-123 (866-263-9123).

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