

Paralysed patients walk again after spinal cord stimulation

Rhys Blakely Science Correspondent

Three paralysed people have regained the ability to walk after pioneering therapy that gives hope to thousands of spinal accident victims.

Jered Chinnock, 29, could not move his legs after breaking his back in a snowmobile accident in Wisconsin in 2013.

He took the first steps since his injury after a surgeon implanted a device that delivers a mild electrical current to his spinal cord, below the point at which it was damaged.

"It feels like science fiction," Mr Chinnock said of the treatment in *Nature Medicine*. "The first day they turned it on, it was almost mind-blowing... I was able to move my toes."

Two weeks after the electrode was activated, he could stand and intentionally make step-like movements while suspended in a harness. He then had more than 40 weeks of intensive physical therapy and is now able to walk with the aid of a Zimmer frame. He said: "Lift the leg — kick the foot out" — that's pretty much what I say to myself every step." When the spinal electrode is switched off he cannot walk.

How the experimental technique works is not yet fully understood. However, a team of researchers from the University of Louisville yesterday reported similar results in *The New England Journal of Medicine*. They used spinal cord stimulation on four patients, all of whom had been paralysed for at least two years.

Two re-learned to walk using a frame or parallel bars for support. "This study truly changed my life," Kelly Thomas,

From rats to humans: a decade of advances

2009 Researchers at the University of California in Los Angeles find that a combination of drugs, electrical stimulation to the spinal cord and treadmill exercise can enable paralysed rats to walk.

2011 Rob Summers, the first human to undergo epidural stimulation of the spinal cord, regains ability to move his arms and legs.

2014 Darek Fidyka, a paralysed Polish man, walks again after special

cells from his nasal cavity and grafts of nerve tissue from his ankle are used to repair his spinal cord, which was cut in a knife attack.

2015 Mark Pollock, who had been completely paralysed for four years, is able to walk again when spinal stimulation gives him enough voluntary control over his legs to use a robotic exoskeleton device.

2017 Andrew Meas, who broke his neck in a motorcycle accident, is

able to stand on one leg after having spinal cord epidural stimulation. He had been paralysed from the chest down.

2018 A study in Australia suggests that half of people suffering from serious spinal cord injuries still demonstrate lingering traces of a sense of touch. The research shows that the brains of these people reacted to tactile stimulation, even though they could not actually "feel" anything.

23, from Florida, said. "It has provided me with hope I didn't think was possible after my car accident. One minute I was walking with the trainer's assistance and, while they stopped, I continued walking on my own. It's amazing."

The therapy, which costs about \$350,000 (£267,000) per patient, consists of two treatments. The electrode implant applies a continuous current to the lumbosacral spinal cord, in the lower back. This location corresponds with dense networks of nerves that largely control the movement of hips, knees, ankles and toes.

The patients undergo an intensive form of physical therapy that aims to

retrain the spinal cord to "remember" the pattern of walking.

Researchers speculate that the technique works, in part, because the spinal cord is not entirely severed and is still able to relay instructions from the brain, but at a weaker level. Electrical stimulation below the injury site might be thought of as amplifying that signal. Dr Claudia Angeli, of the University of Louisville, said. The circuits of nerves linked to walking appear to be reactivated, she said.

The technique has also shown promise in improving bowel, bladder and sexual functions of paralysis victims.

About 1,200 people are paralysed in Britain by spinal cord injuries each year. There are about 40,000 people living with paralysis in the UK.

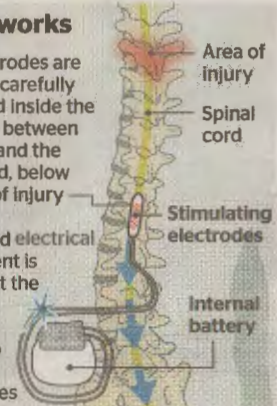
Over the course of a day, Mr Chinnock has been able to walk just over 100 metres. However, he still has no feeling in his legs.

His implant sits in the epidural space — the outermost part of the spinal canal, between the bones of his vertebrae and his spinal cord. The electrode connects to a pulse generator device implanted under the skin of his abdomen, which can be operated wirelessly using a remote control.

Dr Kristin Zhao, of the Mayo Clinic, the medical centre in Minnesota where Mr Chinnock was treated, said: "Now I think the real challenge starts, and that's understanding how this happened, why it happened, and which patients will respond."

The research was partly funded by the foundation of the late actor Christopher Reeve, who was paralysed after a horse riding accident in 1995.

How it works

- 1 Electrodes are very carefully positioned inside the vertebrae between the bone and the spinal cord, below the level of injury
 - 2 A mild electrical current is directed at the specific nerves needed to activate the muscles
- 
- The diagram illustrates the spinal cord with a red area at the top labeled 'Area of injury'. Below this, the 'Spinal cord' is shown. A red circle labeled 'Stimulating electrodes' is positioned between the vertebrae below the injury level. A blue line labeled 'Internal battery' is shown at the bottom, connected to the electrodes.

Times 25.9.2018