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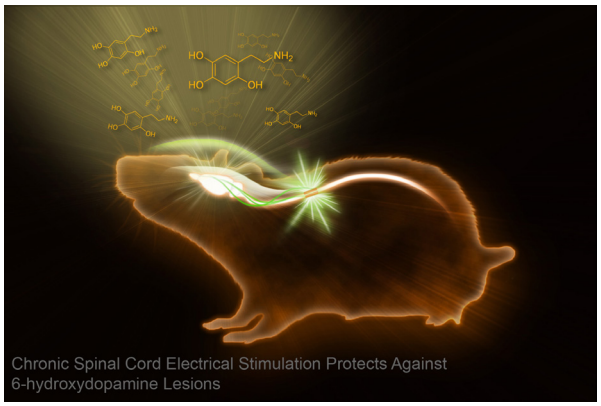
Long-Term Spinal Cord Stimulation Stalls Parkinson's Symptoms

DURHAM, N.C. -- Researchers at Duke Medicine have shown that continuing spinal cord stimulation appears to produce improvements in symptoms of Parkinson's disease, and may protect critical neurons from injury or deterioration.



The study, performed in rats, is published online Jan. 23, 2014 in the journal Scientific Reports. It builds on earlier findings from the Duke team that stimulating the spinal cord with electrical signals temporarily eased symptoms of the neurological disorder in rodents.

"Finding novel treatments that address both the symptoms and progressive nature of Parkinson's disease is a major priority," said the study's senior author Miguel Nicolelis, M.D., Ph.D., professor of neurobiology at Duke University School of Medicine. "We need options that are safe, affordable, effective and can last a long time. Spinal cord stimulation has the potential to do this for people with Parkinson's disease."

Parkinson's disease is caused by the progressive loss of neurons that produce dopamine, an essential molecule in the brain, and affects movement, muscle control and balance.

L-dopa, the standard drug treatment for Parkinson's disease, works by replacing dopamine. While L-dopa helps many people, it can cause side effects and lose its effectiveness over time. Deep brain stimulation, which emits electrical signals from an implant in the brain, has emerged as another valuable therapy, but less than 5 percent of those with Parkinson's disease qualify for this treatment.

"Even though deep brain stimulation can be very successful, the number of patients who can take advantage of this therapy is small, in part because of the invasiveness of the procedure," Nicolelis said.

In 2009, Nicolelis and his colleagues reported in the journal Science that they developed a device for rodents that sends electrical stimulation to the dorsal column, a main sensory pathway in the spinal cord carrying information from the body to the brain. The device was

attached to the surface of the spinal cord in rodents with depleted levels of dopamine, mimicking the biologic characteristics of someone with Parkinson's disease. When the stimulation was turned on, the animals' slow, stiff movements were replaced with the active behaviors of healthy mice and rats.

Because research on spinal cord stimulation in animals has been limited to the stimulation's acute effects, in the current study, Nicolelis and his colleagues investigated the long-term effects of the treatment in rats with the Parkinson's-like disease.

For six weeks, the researchers applied electrical stimulation to a particular location in the dorsal column of the rats' spinal cords twice a week for 30-minute sessions. They observed a significant improvement in the rats' symptoms, including improved motor skills and a reversal of severe weight loss.

In addition to the recovery in clinical symptoms, the stimulation was associated with better survival of neurons and a higher density of dopaminergic innervation in two brain regions controlling movement – the loss of which cause Parkinson's disease in humans. The findings suggest that the treatment protects against the loss or damage of neurons.

Clinicians are currently using a similar application of dorsal column stimulation to manage certain chronic pain syndromes in humans. Electrodes implanted over the spinal cord are connected to a portable generator, which produces electrical signals that create a tingling sensation to relieve pain. Studies in a small number of humans worldwide have shown that dorsal column stimulation may also be effective in restoring motor function in people with Parkinson's disease.

"This is still a limited number of cases, so studies like ours are important in examining the basic science behind the treatment and the potential mechanisms of why it is effective," Nicolelis said.

The researchers are continuing to investigate how spinal cord stimulation works, and are beginning to explore using the technology in other neurological motor disorders.

In addition to Nicolelis, study authors include Amol P. Yadav of Duke University; Hao Zhang, Thais Vinholo and Chi-Han Wang of Duke University School of Medicine; and Romulo Fuentes and Marco Aurelio M. Freire of the Edmond and Lily Safra Institute of Neuroscience of Natal in Brazil.

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