Enhancing Plasticity and Recovery Following Spinal Cord Injury

Published date: Aug. 14, 2017

Technology description

Spinal cord injury (SCI) can lead to a wide range of functional impairments that reduce the independence and quality of life for millions worldwide. Intense rehabilitation therapy is the most consistently effective therapy for SCI patients, but serious impairments may persist even after years of treatment.While the impairments that result from SCI are primarily determined by the location and extent of the damage, there is increasing evidence that recovery from SCI is not predetermined by the lesion – opening up possibilities for enhancing treatment of SCI with new methods, such as plasticity-based therapeutics.

Pairing vagus nerve stimulation (VNS) with forelimb rehabilitation in rats with identical cervical SCI (cSCI) promoted over 75% greater recovery of forelimb function compared to rehabilitation alone. Such significant differences in recovery between similarly-injured groups suggest that neural plasticity plays a critical role in limiting functional recovery after SCI.

Figure 1. Graphical summary of the anatomical, physiological, and behavioral benefits of adding VNS to rehabilitation.Percentages indicate the proportion of successful trials, the proportion of motor cortex sites that close the digits, and the proportion of labeled motor cortex neurons compared to unlesioned rats.

Technical Summary:

This study provides the first direct demonstration that VNS paired with rehabilitative training can promote functional recovery and generate beneficial neural plasticity, as shown in the increasing number of functional synaptic connections in descending networks from the motor cortex to the target forelimb musculature. Both unilateral and bilateral cervical SCI showed enhanced recovery when rehabilitative training was paired with VNS. These findings suggest that neural plasticity, not lesion extent, primarily limits recovery from SCI and supports the case for plasticity-based therapies in spinal cord rehabilitation.

Value Proposition:

The addition of VNS as an adjuvant to rehabilitation substantially improves the anatomical and physiological connectivity of motor circuits and enhances recovery (over 75% compared to rehabilitation alone) in animal models with similar SCI.

Application area

Spinal Cord Injury Therapy
Voluntary Motor Control Therapy
Neurological Therapy – motor, sensory, and cognitive symptoms

Advantages

Enhances Recovery – Promotes greater recovery than intense rehabilitation alone between identically-injured animal models.
Plasticity-Based – Generates beneficial neural plasticity, which is suggested to primarily limit recovery from SCI over lesion extent
Improved Connectivity - Improved anatomical and physiological connectivity of motor circuits, improves voluntary motor control

Institution

University of Texas, Dallas

Inventors

Michael Kilgard
Professor
Behavioral and Brain Sciences
Patrick Ganzer
Research Associate
Medical Devices
Seth Hays
Assistant Professor
Bioengineering
Robert Rennaker
Professor
BBS & EE

联系我们

叶先生

电 话：021-65679356

手 机：13414935137

邮 箱：yeyingsheng@zf-ym.com