

# Motion-Activated, Closed-loop Non-invasive Vagus Nerve Stimulation as a Neurorehabilitation Tool

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## Technology description

### Technology:

Surgeons and researchers at MUSC have created a non-invasive, motion-activated, closed-loop vagus nerve stimulation (VNS) device that enhances neuroplasticity to accelerate motor restoration in post-stroke rehabilitation. The device couples VNS with limb motion to provide stimulation simultaneously with movement, enhancing the effects of post-stroke rehabilitation. As an example, when the arm is targeted, different muscle groups in the arm can be monitored by EMG electrodes. Limb movement can be initiated by the patient independently or can be guided by a robotic or therapist. Once arm motion is detected, a non-invasive surface electrode at the ear or neck stimulates the vagus nerve in a closed-loop system to neurologically reinforce that motion. Pairing neurological stimulation and motor movements can reduce rehabilitation time and enhance the magnitude of the effects of standard motor therapy without permanent medical devices.

### Overview:

Nearly 800,000 people in the United States have a stroke every year. The most common long-term functional disability post-stroke is motor impairment: 85% of stroke cases result in upper limb debilitation. Loss of arm, or any limb, function has a severe negative impact on daily living. The most widely used treatment for patients who have suffered from a stroke is professional motor rehabilitation, while some others opt for experimental robotics, virtual reality techniques, or long-term brain stimulators. However, these options do not restore neural activity sufficiently to regain function, involve invasive surgery, or are financially out of reach for many patients. As such, a novel rehabilitation tool that provides superior patient outcomes and accelerated rehabilitation times would be a welcome addition to this market space.

Key Words: Vagus Nerve Stimulation, Non-invasive, Closed-Loop, Neurorehabilitation

## Application area

Stroke, Motor Rehabilitation, Neurorehabilitation

## Advantages

Accelerated Rehabilitation:Combining VNS and motor training reduces rehabilitation time needed.  
Increased Rehabilitation Effect:Adding VNS to motor training gives improved results compared to either treatment on its own.

Adaptable:System runs on its own and can be combined with therapist, robotic, or other external assistance.

## Institution

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