Cleveland Clinic Innovations

Stimulation of Peripheral Nerves Using Microcoils

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PRODUCT

The use of a microcoil to stimulate peripheral nerves for treatment of neurologic conditions

INDICATION

Peripheral nerve stimulation, electromagnetic stimulation, neurological treatment

VALUE PROPOSITION

- Electrode corrosion and tissue damage can be avoided.
- More robust response over a long period of time.
- Production and quality control advantages over current electrical stimulation procedures.

DEVELOPMENT STAGE

- Proof of concept
- Computational model developed

PUBLICATION

Gale, John T. et al. “Solenoidal Micromagnetic Stimulation Enables Activation of Axons With Specific Orientation.” *Frontiers in physiology* vol. 9 724. 27 Jul. 2018

INTELLECTUAL PROPERTY

US Patent 9,999,781

CONTACT INFORMATION

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UNMET NEED

Current electrical stimulation technologies for peripheral nerves use direct interfaces between the metal of the device and biological tissue. Depending on the current injected into the tissue, oxidation and reduction reactions can occur at the neural interface, causing tissue damage and electrode corrosion to occur. Additionally, direct neural interface can act as a heat sink in MRI scanning machines, preventing patients with implanted peripheral nerve electrodes from getting important imaging completed. A safer, less cumbersome, and more effective technology for stimulating peripheral nerves is needed.

SOLUTION

This invention involves the use of mircocoils to stimulate peripheral nerves without direct metal-to-tissue contact by using electric field induction. The time-varying electric current through the coil induces a magnetic field into the tissue to activate neurons. With magnetic stimulation, since there is no direct contact between metal electrodes and biological tissue, electrode corrosion due to oxidation and tissue damage due to reduction can be avoided. In addition, radio frequency heating in MRI scanning can also be avoided. The coil can be easily printed using a 3D printer on an elastic material and can be coated with a biologically compatible material to reduce negative immune response and tissue encapsulation that could reduce the efficacy of the stimulation over time. The many applications of peripheral nerve stimulation include vagus nerve stimulation for epilepsy, stimulation for spinal cord injuries, pudendal nerve stimulation for bladder control, hypoglossal nerve stimulation for sleep apnea treatment, and peroneal nerve stimulation for stroke applications.