

BRAIN SURGERY: IMPROVEMENT OF DEEP BRAIN STIMULATION METHODS, SYSTEMS AND DEVICES

On-demand and Specifically Targeted Brain Pulses to Treat Tremors and The Like

Invention

Methods, systems, and devices for enhancing both efficacy and efficiency of Deep Brain Stimulation – electrical stimulation known to inhibit symptoms of neurological diseases, disorders, and the like, such as tremors in Parkinson's disease; and to substantially reduce power demands for Deep Brain Stimulation. [U.S. Patent 8,024,049]

Advantages

- Compact, more durable and easier to use design
- Targeted, single, on-demand pulse can be generated only when needed and only to the specific affected point(s)
- Substantially reduced power demands
- Self-contained miniaturization at the implant site



Background

Deep Brain Stimulation (DBS) is a form of brain surgery used to treat several neurological disorders including Parkinson's disease. This treatment is typically introduced as an option to patients after neuro-medicines or drugs have proven ineffective or harmful and current methods can be cumbersome and uncomfortable for the patient. In DBS, electrical pulses are sent through skull-implanted electrodes to block abnormal activity in the brain by targeting the movement center. These skull-implanted electrodes are connected by wires run under the skin down along the neck to one or two card-deck size battery packs implanted under muscle tissue in the chest, similar to a pacemaker. An electrical pulse is continuously generated in a 360 degree space in the brain even when there is no tremor, potentially resulting in unnecessary and harmful side effects. The combination of large amounts of voltage, amperage, and duty cycle creates a power drain that normally requires a non-renewable battery replacement in approximately 3-5 years.

The invention meets these challenges by providing methods, systems, and devices that are compact, targeted, and use substantially less power with the potential for fewer side effects. The improved design avoids implanting large card-deck size batteries in the chest and eliminates the vulnerable wires run under the skin between the electrodes in the skull and the battery in the chest by mounting a miniature battery pack at or near the implanted electrodes in the skull. Both the electrodes sending the electrical pulses and the battery powering the electrical pulses are implanted through a single opening in the skull which improves patient comfort. The direction and the shape of the pulses that prevent abnormal brain activity from happening, such as the beginning of a tremor, can be tailored to generate as a single, on-demand pulse to the specific affected point(s). This prevents the patient from suffering from unnecessary side effects caused by receiving a continuous series of un-synchronized pulses to both the affected and to unaffected regions of the brain. Because the device is not always "on" generating continuous pulses, it uses substantially less power than current DBS techniques and apparatus.

Applications

The improved DBS methods, systems, and devices can be used to treat patients with neurological disorders, especially tremors as is common in Parkinson's disease. Additionally, it can be used to treat other neurological disorders such as epilepsy, psychiatric and behavioral dysfunctions.

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Keywords

Deep Brain Stimulation, Parkinson's, tremors, neurological, motor symptoms, electrode, electrical pulse, neurons, skull-implanted

