A method to optimize neural activity blocking therapies

Unmet Need

The use of kilohertz frequency (KHF) as neuromodulatory therapies that block unwanted neural activity have been applied to treat chronic pain, phantom limb pain, obesity, and other applications. However, the high energy demands of KHF electrical signals reduce the lifetime of primary cell implantable pulse generators (IPGs) and increase the size and/or recharge frequency of rechargeable IPGs. Frequent recharging of batteries is cumbersome for the patients, while replacement surgery of primary cell batteries is costly and involves the typical risks associated with surgery, including infection. Furthermore, higher energy waveforms may also increase the risk of tissue damage. In addition, KHF block is associated with an "onset response" that can cause undesirable side effects including pain and muscle contraction. Current approaches for selecting waveform parameters are crude for KHF devices. The devices generally use a fixed waveform and frequency, and the other parameters are set either by the physician or a company representative during a short appointment. The amplitude is generally simply set as high as possible without patient discomfort. Therefore, there is a clear need to optimize the performance of electrical signals for production of block of neural activity.

Technology

Duke inventors have developed a method for optimizing neuromodulatory therapies and reducing unwanted side effects. This is intended to improve neural device treatments for various diseases associated with pathological neural activity. Specifically, this is a method to identify an optimized waveform shape for blocking neural conduction. The optimized waveforms

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are identified through use of a global optimization algorithm based on predetermined performance criteria. A plurality of waveforms is generated and evaluated for neuronal conduction block using a computational model of extracellular neuronal stimulation, and a candidate waveform having an optimized shape capable of blocking neural conduction is identified. This technology has been demonstrated in lab simulations.

Advantages

- Enables the blocking of unwanted neural activity while reducing unwanted side effects
- Can improve neuromodulatory therapies to treat chronic pain, phantom limb pain, and other applications
- Reduces the energy demands to achieve conduction block substantially