



Spinal cord stimulation for motor rehabilitation in neurodegenerative disease

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Abstract

Epidural electrical stimulation of the spinal cord (SCS) has been used for several decades to treat chronic pain. Recently it has been suggested that it can be used for symptomatic treatment of motor disorders, such as Parkinson's disease (PD). PD is a chronic and progressive neurodegenerative disease that involves the destruction of dopaminergic cells of the substantia nigra, depleting the striatum of dopamine and hence causing motor deficit expressed as bradykinesia, resting tremor, rigidity and difficulty to start locomotion. A leading symptomatic treatment of PD is the replacement of dopamine by pharmacological means, nonetheless, this approach lacks efficacy in the long term. Direct electrical stimulation of subthalamic nucleus and other areas, generically known as deep brain stimulation, is another way to alleviate the motor symptoms. This method is very efficient but still restricted to a subset of patients, partly because it is an invasive procedure. The idea of proposing SCS for PD came from two observations, first, low-frequency synchronization of neural activity is a hallmark of PD, and second, similar synchronized activity is present in other neurological diseases and can be disrupted by high-frequency stimulation of peripheral nerves. I will discuss evidence obtained in rodents and primate models that supports the use of SCS for treating some PD symptoms, specially those related to locomotion. I also will discuss the potential mechanisms that account for this effect as well as future experiments towards solving relevant questions before proceeding to clinical trials.

Recommended references with the talk

- Grillner S, Hellgren J, Ménard A, Saitoh K, Wikström MA. Mechanisms for selection of basic motor programs--roles for the striatum and pallidum. *Trends Neurosci.* 2005 Jul;28(7):364-70. Review

- Fuentes R, Petersson P, Siesser WB, Caron MG, Nicolelis MA. Spinal cord stimulation restores locomotion in animal models of Parkinson's disease. *Science.* 2009 Mar 20;323(5921):1578-82.

- Fuentes R, Petersson P, Nicolelis MA. Restoration of locomotive function in Parkinson's disease by spinal cord stimulation: mechanistic approach. *Eur J Neurosci.* 2010 Oct;32(7):1100-8. doi: 10.1111/j.1460-9568.2010.07417.x. Review