Studying Sensory Discrimination Via Spinal Cord Stimulation Induced Artificial Sensation In Rodents

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Abstract

Lack of sensory feedback is a major challenge affecting patients with neurological diseases such as Parkinson's disease, stroke, and spinal cord injury (SCI). Lack of sensory information might cause patients to lose their motor functions. Spinal cord stimulation (SCS) has been hypothesized as a technique for restoring somatosensory sensations. It has been proven as a suitable treatment option in clinical applications due to being less invasive than a brain implant. In previous studies investigating the role of SCS in generating artificial sensations in rodents and non-human primates, we found that the stimulus detection threshold decreased with higher frequency, longer pulse-width, and increasing duration of SCS. Moreover, sensory discrimination of SCS-induced sensations in rats obeyed Weber's law of just-noticeable differences (JND). Here we plan to alter the coefficient of variance (CV) of aperiodic pulses to train rats to determine whether rats can differentiate between periodic and aperiodic pulse trains. Subsequently, receiver operating characteristic (ROC) curves, in which true positive and false positive rates are plotted against each other, will be created using initial training data and used to analyze how each rat learns over time. Thereafter, varied stimulation parameter combinations would be provided to determine the minimum difference between two CV stimuli, i.e., JND that the rats can discriminate. Furthermore, these findings suggest that varying the periodicity of SCS patterns can evoke different sensory experiences. We posit that SCS can provide intuitive sensory feedback in neuroprosthetic devices. This information characterizes how artificial sensation may be used in the medical field to help patients interact with and receive information from their environment.