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Brain Computer Interface for Spinal Cord Injury

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Editorial

Spinal cord injury (SCI) is a chronic paralysis that needs a long-term health, economic, and social issue worldwide. A major goal of the physicians and therapists is to enhance the restoration of movements lost after SCI. Following decades of research about the central nervous system (CNS) has advanced greatly, however, it is till little known about the inducing successful regeneration, especially in the chronic SCI state [1].

Brain–computer interfaces (BCIs) are used to translate brain activity signals into control signals for external devices. Furthermore, BCI has proven to be a useful tool for providing alternative communication and mobility to patients suffering from nervous system injury [2]. For the patients suffering from SCI, BCI can be an effective tool regarding to improving their quality of life through strengthening the efficacy of the residual neuronal pathways or controlling of replacement devices.

BCI combined with functional electrical stimulation (FES) has been attracted more and more attention for its possibility to restore the basic movements in SCI patients. The BCI technology makes the direct brain control of FES systems possible. BCI-triggered FES system has been build up to help the monkey suffered SCI to control grasping movement, which is not possible after SCI [3]. Furthermore, BCI-triggered FES system has also successfully applied to SCI patients. Rohm M [4] designed this system to make an SCI patient to induce movement in the hand, fingers, and elbows with about 70% accuracy.

Particularly, it would also result in a large gain in quality of life for the SCI patients through the neuroprosthetics to replace their missing or weak movement function. BCIs are often directed at assisting and augmenting the patients' motor functions through brain-controlled robot arms [2], wheelchairs [5], or cursors on computer screens [6]. Furthermore, the BCI system can be used to combined multiple pathways for movements together to make it more viable in everyday applications [7]. A hybrid-BCI system is developed to the control wheelchair of velocity and direction through combining motor imagery and P300 [5]. Furthermore, based on this system, SSVEP and P300 are coupled to improve the asynchronous BCI's ability to distinguish between go and stop commands [8]. Motor imagery based BCI is also applied to control a robotic-leg orthosis for an SCI patient successfully [2].

Taken together, BCI appears to be promising technology to increase the life quality for the SCI patients through restoring motor functions by affecting neural plasticity or replacing motor functions with computerized devices.

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