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Deep brain stimulation system for behavioral investigation of parkinsonian animal model

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DBS of the STN is regarded as a one of the most effective neurosurgical therapies for patients with Parkinson's disease, but the real functional mechanism is not well known. To elucidate the basic mechanism of DBS, many animal behavioral tests have been conducted. But the tests are carried out under unnatural environment by external components, for example, large stimulator, cable, and so on. It could affect to the test results. To enable more natural and free moving of subjects, we devise animal DBS system that can be implanted in a living body using hermetically sealed packages and there are no external components. All materials used in making the system are biocompatible. Because the whole system is implanted in the subject, the infection problem could be minimized. The DBS system consists of current stimulation chip, electrode, hermetic package, battery, and lead cable. The chips can deliver stimulation current from 2uA to 1,024uA with 2uA step and other stimulation parameters are changeable, that is, pulse duration (10us~160us with 10us step) and stimulation rate (10pps~800pps). The stimulation electrode is designed to have minimal volume to minimize the physical lesion effect and is stereotactically implanted into the STN in the rat induced by unilateral 6-OHDA lesioning. Assumptions about the mechanisms mediating the effects of lesion of the nigrostriatal dopaminergic pathway by 6-OHDA and the effects of STN-DBS were examined behaviorally. Our results show that DBS of the STN in the dopamine-depleted rats decrease apomorphine-induced rotational behavior and restore motor function in spontaneous behavior. Therefore, our animal DBS system could be a useful instrument for investigation of parkinsonian disease.

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