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# Biocompatibility Tests for Chronic Application of Sieve-Type Neural Electrodes in Rats

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**Abstract :** Identifying the chronic functions of an implanted neural electrode is an important factor in acquiring neural signals through the electrode or restoring the nerve functions after peripheral nerve injury. The purpose of this study was to investigate the biocompatibility of the chronic implanted neural electrode into the sciatic nerve. To do this, a sieve-type neural electrode was implanted at proximal and distal ends of a transected sciatic nerve as an experimental group (Sieve group, n=6), and the end-to-end epineural repair was operated with the cut sciatic nerve as a control group (reconstruction group, n=6). All surgeries were performed on the sciatic nerve of the right leg in Sprague Dawley rats. Behavioral tests were performed before and 1, 4, 7, 10, 14, and weekly days until 5 months following surgery. Changes in sensory function were assessed by measuring paw withdrawal responses to mechanical and cold stimuli. Motor function was assessed by motion analysis using a Qualisys program, which showed a range of motion (ROM) related to the joints. Neurofilament-heavy chain and fibronectin expression were detected 5 months after surgery. In both groups, the paw withdrawal response to mechanical stimuli was slightly decreased from 3 weeks after surgery and then significantly decreased at 6 weeks after surgery. The paw withdrawal response to cold stimuli was increased from 4 days following surgery in both groups and began to decrease from 6 weeks after surgery. The ROM of the ankle joint was showed a similar pattern in both groups. There was significantly increased from 1 day after surgery and then decreased from 4 days after surgery. Neurofilament-heavy chain expression was observed throughout the entire sciatic nerve tissues in both groups. Especially, the sieve group was showed several neurofilaments that passed through the channels of the sieve-type neural electrode. In the reconstruction group, however, a suture line was seen through neurofilament-heavy chain expression up to 5 months following surgery. In the reconstruction group, fibronectin was detected throughout the sciatic nerve. However, in the sieve group, the fibronectin was observed only in the surrounding nervous tissues of an implanted neural electrode. The present results demonstrated that the implanted sieve-type neural electrode induced a focal inflammatory response. However, the chronic implanted sieve-type neural electrodes did not cause any further inflammatory response following peripheral nerve injury, suggesting the possibility of the chronic application of the sieve-type neural electrodes. This work was supported by the Basic Science Research Program funded by the Ministry of Science (2016R1D1A1B03933986), and by the convergence technology development program for bionic arm (2017M3C1B2085303).
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