Effects of vibration therapy on immobilization-induced hypersensitivity in rats

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key words  immobilization · hypersensitivity · vibration

[Purpose] Cast immobilization induces mechanical hypersensitivity, which disrupts rehabilitation. The purpose of this study was to investigate the preventive and therapeutic effects of vibration therapy on immobilization-induced hypersensitivity.

[Methods] Thirty-five Wistar rats (8-weeks old; all male) were used. The right ankle joints of 30 rats were immobilized by plaster casts for 8 weeks, and 5 rats were used as controls. The immobilized rats were divided randomly into three groups: 1) immobilization-only group (Im, n = 10), 2) vibration therapy group 1, with vibration therapy initiated just after the onset of immobilization (Im + Vib1, n = 10), and 3) vibration therapy group 2, with vibration therapy initiated 4 weeks after the onset of immobilization (Im + Vib2, n = 10). Vibration was applied to the hind paw for 15 min, once a day, for 5 days a week. The mechanical hypersensitivity and epidermal thickness of the hind paw skin were measured. To investigate central sensitization, the expression of the calcitonin gene–related peptide (CGRP) in the spinal cord and dorsal root ganglion (DRG) was analyzed.

[Results] Immobilization–induced hypersensitivity was inhibited in the Im + Vib1 group but not in the Im + Vib2 group. Central sensitization, which was indicated by increased CGRP expression in the spinal cord and an increased DRG area with CGRP–positive neurons, was inhibited only in the Im + Vib1 group. Epidermal thickness was not affected by vibration stimulation.

[Discussion] The reduction of CGRP overexpression in the spinal cord and DRG, which shows inhibition of the central sensitization, was observed in only the Im + Vib1 group. Our data suggested that the initiation of vibration therapy in the early phase of immobilization might inhibit the development of immobilization–induced hypersensitivity.