

Title: A Novel Pain Rehabilitation Technique

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Editorial

Complex regional pain syndrome (CRPS) or allodynia occurs in approximately 50% of patients because of the extended immobilization period [1]. Although immobilization is considered to be a cause of chronic pain, when pain is experienced, it is difficult to input afferent information from the periphery to the brain by forcibly performing movements. During the immobilization period, the way the brain comprehends the somatology is important for preventing chronic pain. Many previous studies have shown that brain activity while performing actual movements and brain activity while imagining the movements are equivalent; presentation of an image or illusion of the movement may allow patients to maintain brain activities related to somatotomy, thereby preventing chronic pain.

Therefore, based on this, rehabilitation using the illusion or an image of the movements has attracted much attention. For example, vibratory stimulation of the tendons causes firing of muscular spindles, and the stimulated spindles from the afferent input are perceived to be extended, resulting in an illusion of movement, similar to articular movements. A previous study has reported that when vibratory stimuli were applied during immobilization caused by arthrodesis in the hands and fingers, a proper activity was performed in the motor-related areas of the brain, including the primary motor area, after removal of the fixture, whereas activity in these areas was reduced in the group without vibratory stimuli [2]. We performed an intervention by applying vibratory stimuli during a seven-day period to a degree that would not cause pain and by causing an illusion of movement in patients who were forced to fix joints after a surgery for distal radius fractures. We observed that the group that received vibratory stimulation showed a greater reduction in pain [3].

Alternatively, many studies have shown that presentation of an image of the movement has a positive effect on pain reduction. For example, the intervention developed by Moseley consisted of three tasks, including 1) a cognitive task of identifying whether the hand presented to the eyes of the subject is the right or left hand, 2) remembering the mental image of the movement that the patients were asked to imagine, and 3) mirror therapy. The results showed that performing the interventions in the order of 1) to 3) reduced pains [4]. Whereas the previous method using vibratory stimulation was a bottom-up approach that led the brain to form motor perceptions using afferent information obtained from the periphery, this method,

using a motor image, is a top-down approach that involves creation of a motor perception based on the memory in the brain. Furthermore, we developed motor observation therapy using the mirror neuron system, which is a system that causes neural activity in a person observing another person perform movement similar to the activity in the person performing the movement [5]. This was developed for patients with cervical pain; the patients are asked to observe the rotation of the cervical areas made by another person standing in front of them and to infer the intention and what the person performing the cervical movements is attempting to see based on the cervical movement. In order to infer the intention, patients must simulate the movement themselves, while observing the movements of the other person. Of course, patients observe the person without accompanying self-movements. The results showed that compared to the group that observed the movements of the person without inferring his/her intention, the group that observed based on certain indices and simulated neck movement while trying to read the intention of the person showed significant pain reduction as well as an increase in the range of motion of cervical joints. This effect has been shown to be significantly higher than that of physical therapies such as electric stimulation and traction treatment. These novel pain rehabilitation techniques have attracted attention over the years as methods of neurorehabilitation in patients with chronic pain or for the prevention of chronic pain.

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