Effects of Practicing Difficult Movements of the Unilateral Arm on the Excitability of Spinal Motor Neurons in the Contralateral Arm

hypothesized that practicing difficult movements reduces the promoting effect on the spinal motor neurons in the contralateral upper limb.

Subjects and Methods

Participants

Sixteen right-handed healthy adults (12 men and 4 women; mean age, 26.1 ± 6.0 years) with no orthopedic or neurological abnormalities participated in this study. They were randomly assigned equally to either a control group (6 men and 2 women; mean age, 26.4 ± 7.2 years) or a practice group (6 men and 2 women; mean age, 26.0 ± 4.9 years). The Edinburgh handedness inventory [12] was used to determine their dominant hands.

In addition to explanations of the objectives of this study, the subjects were informed that the test data would be strictly confidential and that they could withdraw from the study at any time during the course of the study. The subjects' signatures on the study consent forms were obtained once they had agreed to participate. This study was conducted with the approval of the ethics committee of Kobe College of Rehabilitation.

Procedure

The F-waves were derived from the right abductor pollicis brevis muscle during the motor tasks of the left upper limb before and after

	Control group		Practice group	
	Pre	Post	Pre	Post
Amplitude ratio of F/M (%)	1.51 ± 0.47	1.72 ± 0.43	1.43 ± 0.51	1.12 ± 0.26*
Latency (ms)	25.6 ± 1.7	25.6 ± 1.7	26.4 ± 1.4	26.3 ± 1.5
Number of failures (times)	8.4 ± 5.6	7.1 ± 5.5	8.8 ± 3.5	3.8 ± 4.2*
Data are presented as mean ± SDs. *: $p < 0.05$				

Table 1: F-wave parameters and number of failures in the control and practice groups.

Data analysis

The F-waves were analyzed for the amplitude ratio of F/M and latency. The amplitude ratio of F/M was calculated as the ratio of the average peak-to-peak F-wave amplitude and the maximum M-wave amplitude. This parameter represents the percentage of motoneurons activated by the antidromic stimulation [14]. Furthermore, the amplitude of the averaged F-responses at rest in healthy subjects is

addition, Nelson et al. [22] recorded the somatosensory-evoked potentials (SEP) during the motor tasks, such as adjusting the angle of the joint to the correct position, and reported that the input of sensory information to the cerebrum in the central nervous system is reduced when motor tasks are acquired by motor learning; this was because the short latency SEP amplitude decreases with acquisition of the tasks. The present study considered that the facilitation effects of the sensory input and the upper central nervous system associated with voluntary movements of the upper limb on the spinal motor neurons in the contralateral upper limb decrease with the acquisition of tasks through practice.

Conclusion

The present study suggests that the facilitation effects of voluntary movements of the unilateral upper limb that were performed at a high difficulty level on the spinal motor neurons in the contralateral upper limb decrease with motor learning. When performing physiotherapy, understanding the influence of voluntary movements of the unilateral upper limb on the spinal motor neurons in the contralateral upper limb is important. This facilitation effect may be a factor impeding accurate movements. For example, association reactions observed in hemiplegic patients with cerebrovascular disorders increase the muscle tone of the limbs not related to the movement. Selective movement is restricted when muscle tone is increased. Therefore, practicing efficient implementation of difficult movements is necessary. The limitation of