Intention tremor is caused by disorders of the cerebellar system. The kind of movement that exaggerates intention tremor has not yet been established. Thus, to investigate the contexts in which intention tremor is increased, I tested intention tremor patients as they performed two kinds of tasks, one involving sensory-guided movement and the other involving memory-guided movement. I report here on patients in whom intention tremor was exacerbated by sensory-guided movement and improved by memory-guided movement.

Four patients were studied: 3 cases with hemorrhage in the thalamus or superior cerebellar pedunculus, and 1 case with multiple sclerosis (1 male and 3 females, mean age ± SD: 51.5 ± 13.1 years). Intention tremor interfered with skilful movement in all patients. Each had difficulty in writing, grasping a cup, and putting toothpaste on a toothbrush. Paradoxically, intention tremor sometimes decreased in all patients when they manipulated tools with their eyes.

Fig. 1. The traces of the index finger (left) and surface electromyograms (right) during visually guided (a) and memory-guided movement (b). The trace was recorded in one cycle of the movement. Surface electromyogram was continuously recorded on biceps brachii (Biceps), triceps brachii (Triceps), flexor carpi ulnaris (FCU) and extensor digitorum communis (EDC).

Intention Tremor Exaggerated by Visually Guided Movement
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closed. They did not feel a reduction of emotional stress while making fine movements with their eyes shut since they were obliged to do so without visual guidance, indicating that the improvement was not the result of a decrease of emotional stress.

I, therefore, assigned the patients two kinds of tasks according to the method I previously reported [1] and observed how intention tremor differed. First, the patients were asked to follow the movement of a target with their index fingers by performing extension and flexion movements of the elbows. The examiner moved the target vertically in front of the patients within a range of about 60 cm and a time cycle of about 3 s. Next, the patients were asked to mimic the same movements as closely as possible with their eyes closed. I examined the patients performing this set of tasks repeatedly and analyzed their movements through their traces and surface electromyograms. When patients followed the target with their index fingers, intention tremor was prominent. In contrast, when they mimicked the same movements with their eyes closed, they could skillfully move their index fingers, and the trace was smooth (fig. 1). When they tracked the target again after the task without visual guidance, intention tremor reoccurred, which suggests that the improvement is not due to repetition of gestures.

The results indicate that the patients were disturbed by intention tremor when visually tracking a target, but were able to mimic the same movement well with their eyes closed. The former task was considered a visually guided movement, whereas the latter was considered a memory-guided one [1]. To perform the memory-guided task, the patients were forced to precisely imitate the visual tracking movements from before, and this was not simple to do. It was therefore concluded that the act of utilizing visual information to trigger and guide the movement exacerbated intention tremor [1]. Although the use of visually guided and memory-guided tasks has clarified this phenomenon in ataxia [2] and action myoclonus [1], it has not been demonstrated for intention tremor [3].

The results are in agreement with physiological findings that the cerebellar dentate nucleus neurons are involved in the generation and/or guidance of movement based on visual cues, and not in the control of movement based on memories [4]. Thus, it is likely that intention tremor becomes prominent mainly when the cerebellum works to utilize visual information to direct limb movement.

References