

The effects of mental practice on unilateral neglect in patients with chronic stroke: a randomized controlled trial

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Abstract. [Purpose] This study aims to investigate the effects of mental practice on unilateral neglect in patients with chronic stroke. [Subjects] The subjects of this study included 30 patients with chronic unilateral neglect. [Methods] The subjects were randomly divided into either the experimental group (EG) or control group (CG). All subjects received a standard rehabilitation program. In addition to the standard rehabilitation, the EG subjects received mental practice (5 days a week for 4 weeks) for 10 minutes. To compare two groups, line bisection test (LBT) and star cancellation test (SCT) were conducted. [Results] Both groups showed significant improvement in the LBT and SCT. There were statistically significant differences in the changes in LBT, but there were no significant differences in the changes in the SCT between both groups. [Conclusion] This study demonstrated that mental practice may be a valuable additional rehabilitation method in the chronic stage of neglect.

Key words: Mental practice, Stroke, Unilateral neglect

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INTRODUCTION

Unilateral neglect is defined as a failure to attend, respond, or orient toward meaningful stimuli provided in the opposite side of a brain lesion¹⁾. Spontaneous recovery of it is observed in a considerable number of cases within the next few weeks^{2, 3)}; However, some studies indicate that unilateral neglect can be observed in several months after stroke⁴⁾.

In the last two decades, several studies have investigated specific approaches to the rehabilitation of unilateral neglect. Classically, constraint-induced movement therapy and limb activation techniques with repeated movement of neglect side limbs are reported to be helpful to reduction of the symptoms of unilateral neglect and improvement of functional ability. However, unfortunately, these classical rehabilitative approaches required the patients with stroke to move their extremities actively⁵⁾.

In stroke rehabilitation, mental practice has been used to improve physical function and movement using motor and visual representation without actually executing any physical activity so that it can be applied to the patient with low motor function. Mental practice has been widely used because of its convenience, cost effectiveness, and safety⁶⁾.

The imagery of neglect side limb movement is increasing the awareness of neglect side space and the body's image of the neglect side limbs as well as facilitating the ability to learn motor tasks⁷⁾. Several studies concluded some evidence on the effectiveness of the mental practice in reduction of unilateral neglect⁸⁾. However, controversies on the most effective period and methods of treatment phase exist in previous studies.

The effects of mental practice on patients with unilateral neglect have been reported extensively, but only few clinical studies have been carried out which varied in design and methods in their clinical setting^{7, 9, 10)}. Therefore, the this study was designed to investigate the effects of mental practice on patients with unilateral neglect based on existing studies¹¹⁾.

SUBJECTS AND METHODS

Thirty patients with unilateral neglect after stroke were recruited to participate in this study. The inclusion criteria for participation were as follows: (1) left hemiparesis with onset duration of > 6 months; (2) patient with unilateral neglect (> 6.3 mm deviation of the true center of the line in the line bisection test)¹²⁾; (3) cognition (> 23 points in the Korean version of Mini-Mental Status Examination)¹³⁾; (4) no hemianopsia or apraxia; and (5) imagination ability (an average score < 3 in the Vividness of Movement Imagery Questionnaire)¹⁴⁾. All subjects provided written informed consent before participation in the study according to the code of ethics of the World Medical Association (Declaration of Helsinki, version 2004). Eligible subjects were randomly assigned to experimental group (EG) or control group (CG)

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Table 1. Demographic characteristics of subjects

	EG (n = 15)	CG (n = 15)
Gender		
Male	8	6
Female	7	9
Age (years)	61.5 (5.1)	63.6 (6.0)
Etiology		
Hemorrhage	7	8
Infarction	8	7
Onset period (months)	6.8 (0.9)	6.9 (1.0)

Data are mean (SD)

based on a computer-generated randomization program by a research assistant under the blind condition.

During the study period, all subjects followed a daily treatment schedule of a standard rehabilitation program. In addition with the standard rehabilitation, EG subjects received mental practice for additional 10 minutes (5 days a week for 4 weeks).

During mental practice, EG subjects mentally practiced positioning and movement of the left upper limb intensively as possible in a repetitive fashion. EG subjects sat comfortably and leaned back against the back rest with the feet on the floor and imagined the scene while listening to the voice of the researcher for 10 minutes with the eyes closed. The contents of mental practice were to pick up a baseball, a pencil, and a coin in the center of a body using the left hand respectively, and then moved them into a basket lying on the left side. Verbal feedback provided by the subjects assured correct execution of the imagery tasks. Each task was repeated up to 10 times per session. In the beginning of each task, a break time was given to patients in order to induce relaxation and concentrate internally on the left arm.

The author referred to the instructions of previous studies on the mental practice¹⁵. An example of the instruction for mental practice is as follows: "Try to imagine how your left hand grasp the baseball lying in front of you. Extend your left arm, then the elbow straightens. Feel the muscle tension in your arm. Feel how the fingers press around the baseball and hold it. Move the baseball into a basket lying on the left side. Feel how the elbow is moving and forearm is getting up towards a basket. Feel the muscle tension in your arm needed to hold your arm. Feel the tension in the hand and the fingers so that the baseball won't fall. Now release the baseball and then feel the relaxation in the finger"

All subjects were assessed before and immediately after the 4 weeks intervention. For line bisection test (LBT), the overall number of omissions of the 18 lines and the average deviation score (mm) from the objective midline were determined¹⁶. The center of each bar was positioned at eye level aligned to the patient's body sagittal plane. In five consecutive trials, subjects pointed to the estimated center position using either a pencil or a stick. In star cancellation test (SCT), target detection task is also presented to patients on an A4 sheet of paper. The test comprises 52 darkened large stars, 10 short words, and 13 randomly laid out letters, which are all spread around 56 filled small stars. Subjects

Table 2. Subjects' LBT and SCT scores pre and post the intervention

	LBT		SCT	
	Pre	Post	Pre	Post
EG (n = 15)	10.4 (1.5)	5.1 (1.8)**	47.2 (4.2)	53.5 (2.3)**
CG (n = 15)	10.1 (1.5)	7.2 (1.6)**	48.1 (3.6)	53.3 (2.8)**

**p < 0.001. Mean (standard deviation). LBT: Line bisection test, SCT: Star cancellation test

Table 3. Comparison of changes in the LBT and SCT score

	EG (n = 15)	CG (n = 15)
LBT	5.3 (1.0)**	2.9 (1.1)
SCT	6.3 (2.5)	5.2 (2.3)

**p < 0.001. Mean (standard deviation). LBT: Line bisection test, SCT: Star cancellation test

were instructed to cross out all targets, which are subdivided into 6 sections with 27 on each side¹⁷. The number of found stars was counted as scores in this study. All clinical measures were administered by the blinded assessor.

All data analyses were performed using SPSS version 20.0 Using Shapiro-Wilk test, normal distribution of the variables was not found, therefore, non-parametric tests were used. The χ^2 and Mann-Whitney U test were used to compare difference between group means and changes in values, and the Wilcoxon signed-rank test were used to test differences in continuous variables within groups. Statistical significance was accepted for values of $p < 0.05$.

RESULTS

After applying the inclusion criteria, 30 subjects fulfilled the inclusion criteria and were randomly allocated to two groups as follow: 15 to the EG and 15 to the CG. All subject characteristics are summarized in Table 1.

After intervention, the subjects in both groups showed significant increases in the scores of the LBT and SCT ($p < 0.001$) (Table 2). There were statistically significant differences in the changes in LBT ($p = 0.002$), but there were no significant differences in the changes in SCT between both groups ($p = 0.237$) (Table 3).

DISCUSSION

This study investigated the effect of mental practice on unilateral neglect of patients with stroke. The results of this study indicate that the mental practice may have therapeutic benefits for unilateral neglect and is consistent with the results of previous studies^{10, 18, 19}.

Perceiving neglect as an attentional disorder²⁰, mental practice can be assumed to facilitate a directing of attention towards the neglected side of the body, objects, and space which does not automatically imply that attention can also be better directed toward the left side of objects.

Although the effects of mental practice on unilateral

neglect in patients with stroke have been confirmed, the effects were a little bit different depending on the clinical measures⁵⁾. The result of this study showed that no significant difference between the groups was found in the SCT, but there was statistically significant difference between two groups in the LBT. From this puzzling result, it can be conceivable that the LBT and SCT test are qualitatively different tasks that evoke different spatial processing mechanism. The LBT requires the subjects to focus on the horizontal extent of one single specific object. On the other hand, the SCT requires the subjects to scan randomly structured multiple object arrays. Therefore, attention in SCT is more related to visuospatial exploration of different and successive locations on the display²¹⁾.

Several studies have found that stroke patients often orient their bodies and heads toward the side of their lesion even when there is no evidence of unilateral neglect^{20, 22)}. These findings suggest that focus on remediation of gaze and scanning alone is unlikely to be the most effective way to improve visual attention in patients with stroke. Mental practice may represent an alternative approach or also a contribution to the conventional rehabilitation. Also the combination of mental practice and conventional occupational therapy may generally be the most promising approach.

Limitation of this study includes: First, in this study, the effects of mental practice on unilateral neglect were not measurable by all employed neglect tests. One reason might be due to the fact that some neuropsychological tests such as the copying and drawing tasks are less sensitive than SCT and that the scoring of these tasks is also less objective²³⁾. Second, this study used a written examination only for the assessment of unilateral neglect. Since there are many cases of unilateral neglect clinically in the patient's daily life in spite of normal performance in the written examination²⁴⁾, Azouvi et al.²⁵⁾ reported that behavioral assessment showed higher sensitivity when it was together with a written examination, rather than when a written examination was used alone.

The long-term follow-up effects of mental practice were not identified by this study. Therefore, further controlled studies with larger sample sizes and longer interventions are needed to clarify the clinical benefits of mental practice as a rehabilitation approach for stroke patients with unilateral neglect.

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