

Effects of Spaced Retrieval Training on Memory for the Herpes Encephalitis in Hippocampus

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Abstract

This study aimed to investigate the effect of spatial retrieval training for memory in hippocampal herpetic encephalitis through a single case study. The subject of the study was a person diagnosed with herpes encephalitis, and the study design used the 'ABA' design among single subject experimental research designs. The intervention was performed for 40 minutes per section, 12 times in total. The independent variable was spaced retrieval training, and the dependent variables were the recall success rate, the rey-complex figure test, and the facial immediate memory and facial delayed memory of the Korean version of memory assessment scale. After spaced retrieval training, the subject's recall success rate, the rey-complex figure test, and the Korean version of memory assessment scale improved the immediate facial memory and facial delayed memory. As a result of measuring the

treatment maintenance effect after the completion of the rebasing line, the subject's immediate facial memory and facial delayed memory in the rey-complex figure test and the Korean version of memory assessment scale were maintained.

This study demonstrated space retrieval training showed significant improvement in the memory for the herpes encephalitis in hippocampus.

Keywords: Memory, Hippocamps, Herpes, Spaced retrieval training, Errorless learning

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Introduction

Memory is the most basic and important cognitive function, and is the ability to acquire and maintain new information. In addition, it is most likely to be damaged by a complex process using existing knowledge(Yeon E K et al., 2002).

Previous studies on memory have been mainly on antecedent memory loss, which is caused by lesions of the hippocampal complex or diencephalon, a state in which new facts or information that occurred after the lesion cannot be learned or stored(Moscovitch M., 1982). On the contrary, memory loss in retrograde amnesia is more prone to recent memory than remote memory, and this phenomenon is called Ribot's law(Ribot T., 1881).

Herpes encephalitis is a common encephalitis in humans and, if left untreated, has a high mortality rate(Guaiana G et al., 2006; Chaudhuri A et al., 2002). As a sequelae of herpetic encephalitis, memory loss has been reported a lot, mainly due to hippocampal injury of the medial temporal lobe. In particular, when the right medial temporal lobe, including the hippocampus, is damaged, memory loss occurs after the event(Kapur N et al., 1994; Noppeney U et al., 2007). In general, retrograde amnesia after hippocampal injury has a temporal gradient, so it has been known that less information is lost as time passes. The explanation for this is consolidation theory(Marr D., 1997). Consolidation theory refers to a process in which the process of memory recall that was dependent on the hippocampus is

changed to hippocampal independency and is stored as long-term memory in the cerebral neocortex(Murre J M., 1996; Meeter M et al., 2004).

Memory impairment is related to attention and executive function in the early stages of dementia, and episodic memory, which is a memory of events or personal experiences, is remarkable(Clare L et al., 2004). Representative intervention strategies for such memory include practice and repetition, memory strategy training, spaced retrieval training, errorless learning, and the use of external aids(Shin S H et al., 2002).

Spaced retrieval training is a method first suggested by Landauer and Bjork. It is a memory training method that promotes storage of the learning process by repeatedly recalling information while gradually increasing the recollection interval(Linton M., 1988). Depending on the information used, spaced retrieval training includes object-topography association, prospective memory task, object-name association, and face-name association. association) technique. Errorless learning is frequently applied in conjunction with spaced retrieval training or vanishing cues technique(Bier N et al., 2008).

According to a study by Wu, it was attempted to improve memory task performance by applying spaced retrieval training based on error exclusion learning in association with eating activities for dementia patients(Wu H S et al., 2014). In addition, independent performance increased in Basic Activity of Daily Living (BADL) such as eating. In addition, another study of Alzheimer's dementia patients improved the performance of the Instrumental Activity of Daily Living (IADL)(Thivierge S et al., 2008).

However, most of these spaced retrieval training and errorless learning studies have been conducted on senile diseases such as mild cognitive impairment and dementia. Senile memory disorders such as dementia are characterized by progressive and slow progression. Accordingly, through various approaches, drugs, exercise, cognitive therapy, etc. are combined to take a therapeutic approach. However, adequate memory training or cognitive therapy is provided for sudden diseases such as herpes encephalitis, which is insufficient. Therefore, in this study, the purpose of this study was to investigate the effect of spaced retrieval training in patients with herpes encephalitis caused by the direct influence of the hippocampus.

Materials and Methods

Subjects

This study targets patients who were admitted to the Department of Rehabilitation Medicine

of B Hospital in Seongnam-si, Gyeonggi-do and were diagnosed with herpes encephalitis as a result of magnetic resonance imaging (MRI) from a specialist in the Department of Rehabilitation Medicine. The experiment is intended for patients who can stand posture without balance aid or assistive devices, and patients with lesions other than herpes encephalitis or with visual and perceptual problems that may affect the examination are excluded from the study.

The subject was a 56-year-old male who had been working overseas for two years, and was diagnosed as a result of the diagnosis above after visiting a nearby hospital for symptoms of amnesia, such as being unable to find accommodation while working six months ago or remembering the previous work. In particular, he complained of memory loss that he could not recall any recent memories, although he performed walking and daily activities independently without any physical problems.

In the Korean version of montreal cognitive assessment (MoCA-K), 24 out of 30 points, but 0 in the delayed recall category. All other items received perfect scores, and there was no difficulty in the therapist's instructions and implementation in Table 1.

Subjects only performed cognitive therapy twice a day conducted by the Department of Rehabilitation Medicine, and proceeded with interventions and all evaluations for this study from 6 pm. Subjects received sufficient explanations of the study in advance and filled out a consent form for participation, and data collection was conducted over a total of 6 weeks from September to October 2019.

Table 1. Characteristics of the subject

Characteristics	Subject
Gender	Male
Age	56
Duration of disease	6 months
Range of motion	Full range
Manual muscle test	N
Manual function test(Rt./Lt.)	31/31
korean version of montreal cognitive assessment(MoCA-K)	24/30

Materials

Recall success rate

After completing the 40-minute intervention, 5 cards with only the day of the week were presented 5 times in total, 25 times after 10 minutes, matched with each day of the week to recall the activity that had been trained in memory, and the number of successes was converted into the recall success rate.

Rey complex figure test; RCFT

This evaluation is a neuropsychological visual memory test that evaluates various cognitive functions such as visual perception, spatial composition ability, visual memory, and executive functions including visual organization strategies. Copy is used as data to evaluate spatio-temporal perception and composition ability, and the results of immediate and delayed recall are used as indicators of visual memory.

Scores are scored with 0, 0.5, 1 and 2 points for each of the 18 elements presented on the scoring sheet provided separately from the recording sheet. 2 points when the shape and position are drawn correctly, 1 point when one of the shapes or positions is correct, both the shape and position are incorrect, but 0.5 points when the examinee can recognize what the subject was trying to draw, and both the shape and position are incorrect. If you can't figure out what you drew and what you drew, and if you don't draw the element, the score is 0. The points for immediate and delayed recall are the total sum of the scores for the 18 elements (a total of 36 points). This test was evaluated twice before and after intervention (Meyers J E et al., 1995).

Korean version of memory assessment scale; K-MAS

K-MAS is a memory test tool that evaluates memory. MAS developed by Williams in 1991 was standardized by modifying some items to suit the cultural background of Korea. K-MAS is largely composed of short-term memory, language memory, and visual memory. Word learning, sentence memory, word recall, language memory range, visual memory range, visual recognition, visual reproduction, face immediate memory, word delay recall, sentences. It is composed of 12 sub-areas: delayed memory, visual delay recognition, and face delayed memory (Lee H S et al., 1997). In this study, the subject's face-name before and after intervention

In this study, instantaneous facial memory and delayed facial memory tests were selected and used to measure the generalization of recall ability. The Generalizability Coefficients of the instantaneous facial memory test were found to be .75 and the face delay memory as .90. This test was evaluated twice before and after intervention.

Methods

The experimental design of this study used the ABA reversal design among single-subject research

design. The total number of experiments is 12 sessions. Baseline phase A and baseline phase A' are periods of no treatment, and basic data are collected three times each. Basic data were collected after applying treatment for a total of 6 times, once a day, and 40 minutes per session.

Spaced retrieval training

The spaced retrieval training used in this study was used by revising and supplementing the method applied in Lee 's study (Lee Y N., 2014). This study was conducted in a relatively quiet cognitive therapy room in a hospital, and treatment was performed at the same time each time.

The training method shows a card matching the day-day and activity, and he said, "Remember to do 000 on the 0th day." For delayed recall, spaced retrieval training was used in steps of 30 seconds, 1 minute, 2 minutes, 4 minutes, and 8 minutes. In order to prevent an error from occurring during recall, if you do not answer for more than 3 seconds, or if you hesitate or do not know exactly, "If you do not remember, please do not guess. Please tell me that you are not sure. I will tell you the correct answer."

In this way, if the delayed recall of up to 8 minutes without mistakes was successful, the two days of the week-day and activities were remembered and then recalled after 30 seconds. On the other hand, in the case of failure in the intermediate stage, the previous time and the previous stage were reverted. The activities applied between recollection periods were activities that did not require excessive memory, and activities such as putty, jenga, and puzzle were performed to improve small muscle exercise, concentration, and problem solving ability in Fig1.



Figure 1. Intervention Program

Statistical analysis

As a single case study, this study records the RCFT and K-MAS values during the baseline and analyzes the subjects using a visual analysis method using a graph using the measured

data. Calculate the average value of each variable within the period and compare and present the rate of change of each step. If a value exceeding the mean ± 2 standard deviation during the intervention period is measured twice in succession, it is considered to have a therapeutic effect. If it is above the average value of, it is considered to have a treatment lasting effect(Ottenbacher K J., 1986; Marklund I et al., 2006).

Results and Discussion

Results

The result of Recall success rate

The number of successes was recorded every day in order to find out the change in the subject's recall success rate during the baseline, intervention, and re-baseline period, and converted into success rate and presented. After intervening spaced retrieval training, the average recall success rate of the subjects increased from 50% of baseline A to 63.25% of intervention B, increasing 13.25%, and maintained at 63.33% at re-baseline A' in Fig.

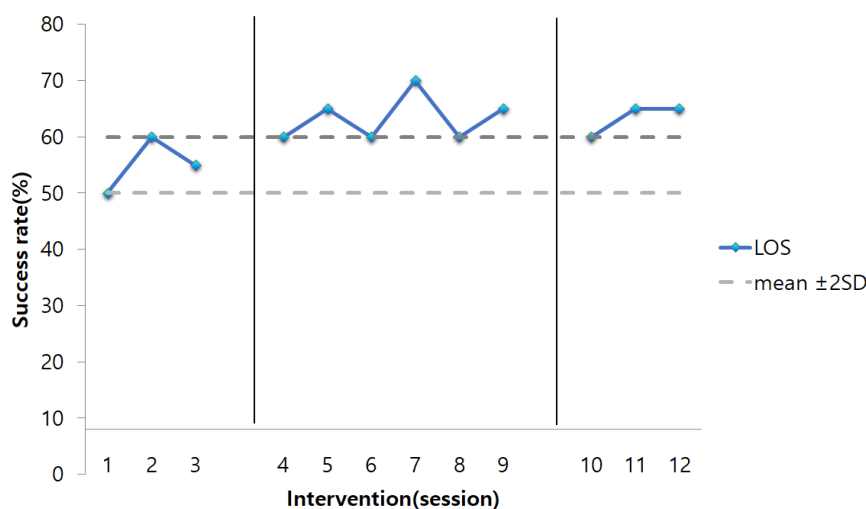


Figure 2. The result of recall success rate

Table 3. Clinical parameters before and after treatment

	Item	pre	post	change
RCFT	Immediate recall	25	29	+4
	Delayed recall	19	22.5	+2.5

K-MAS	Immediate recall	6	10	+4
	Delayed recall	5	6	+1

*rey complex figure test: RCFT; korean version of memory assessment scale: K-MAS

The results of rey complex figure test

Subjects had no problem with compositional ability and imitating drawing, so the results of this study were derived as immediate and delayed recall. Out of a total of 36 points, the average score improved from 25 points to 29 points in immediate recall and from 19 points to 22.5 points in delayed recall in Table.

The results of korean version of memory assessment scale

As a result of the K-MAS measurement, the subjects showed an increase in score from 6 points to 10 points, and all subjects included facial instant memory in the normal category. In addition, the facial delayed memory ability improved from 4 points to 5 points, increasing the facial delayed memory ability from the boundary category to the normal category in Table 3.

Discussion

In this study, spaced retrieval training was performed in patients with herpes encephalitis to investigate changes in memory.

Patients with herpes encephalitis have a retrograde memory disorder rather than a progressive memory disorder(Ribot T., 1881). Retrograde memory disorder was called Ribot'slaw in 1881 when Ribot announced that recent memories are more easily damaged than old memories in retrograde memory disorder(Alvarez R., 1994).

The most widely accepted theory for explaining the Ribot gradient seen in retrograde memory disorder is the coagulation theory. In the early days of memory, the connection between the hippocampus and the cerebral cortex where memories are stored is maintained, and in order to recall the memory, the hippocampus must act as a pointer to stimulate the cerebral cortex related to the memory. However, patients with herpes encephalitis have memory impairment due to damage to the hippocampus, which should act as an indicator.

In patients with memory impairment, communication skills and voluntary behavior decrease due to cognitive decline, and depressive symptoms frequently appear due to indifference, making interpersonal relationships and social participation more difficult(Keightley J et al.,

2004). In particular, sudden decrease in memory, such as herpes encephalitis, greatly affects daily life, further reducing the quality of life. Previous studies on memory impairment include visual imagery, specificity strategies, errorless learning combined with spaced retrieval, time lag training, and external memory aids. , And relative approach (dyadic training or dyadic approach) are reported as effective research methods(Grandmaison E et al., 2003).

As a result of this study, as a result of performing spaced retrieval training in patients with herpes encephalitis, all subjects showed a tendency to gradually increase the recall success rate after intervention compared to baseline. Lee and Kim, who used the same intervention, reported improvement of memory using a number memorization test in patients with mild cognitive impairment, and they are reported the improvement of memory(Lee N R et al., 2013). As such, spaced retrieval training has reported a positive effect on improving memory within a short time by providing repetitive learning and intensive memory training, and improves the satisfaction of the subject. In addition, according to a study by Kixmiller and Lee, it was reported that the effect of cognitive training was higher in subjects with high cognitive level(Kixmiller J S., 2002; Lee S B et al., 2009). In this study, the same result is thought to have occurred because the subjects had higher overall cognitive levels other than memory. It is thought that these functions such as concentration and problem-solving ability had an effect on improving the subject's memory.

As a result of this study, the results of spaced retrieval training in patients with herpes encephalitis showed significant improvement in both RCFT and K-MAS pre-intervention evaluation. In the study of Jean, as a result of performing spaced retrieval training based on error-exclusion learning using face-name association, a significant improvement was found in the memory strategy(Jean L et al., 2010). I think it had an effect on memorizing names. In addition, it was reported that the subject's memory ability in daily life improved after spaced retrieval training based on error-exclusion learning. It is believed that matching training using words commonly used in daily life or face-name, etc., had an effect on improving the subject's memory.

The limitation of this study was that sufficient follow-up studies were not conducted for the subjects showing the effect, and the duration of the effect was not determined after treatment. Also, due to ethical issues, the drug was not restricted. In the future studies to be studied, the diagnosis should be evenly distributed by a randomization method in selecting subjects, divided into two groups, and compared between the comparison group and the control group.

It is believed to be. In addition, research that proves the effectiveness of the protocol that can be applied in various clinical environments by varying the interval between session progression and intervention period should be continued.

Conclusion

The purpose of this study was to apply spaced retrieval training to patients with herpes encephalitis who are admitted to hospital B in Seongnam-si, Gyeonggi-do to confirm changes in memory. The change in recall success rate and the results of analyzing the subject's electrical memory using RCFT and K-MAS before and after intervention are as follows.

First, in patients with herpes encephalitis, as a result of checking the change in the recall success rate at each baseline, intervention, and rebaseline session, it was confirmed that it was significantly improved and maintained continuously.

Second, the results of evaluating RCFT and K-MAS before and after intervention in herpes encephalitis patients showed significant improvement.

Through the results of this study, it was found that spaced retrieval training is an effective and positive intervention for improving memory in patients with herpes encephalitis.

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