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Case Study

Efficacy of mental practice on paralyzed upper extremity function in the acute phase of stroke: a case study

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Abstract. [Purpose] Mental practice (MP) is a method of rehabilitating upper extremity function on the affected side of the body post-stroke, with the aim of improving motor task performance through the sustained repetition of motor imagery (MI). However, most studies thus far have investigated MP for post-stroke paralytic upper limb function in patients in the chronic phase. Therefore, it is necessary to obtain evidence regarding whether MP is an effective intervention modality in the acute phase of stroke. In the present study, we examined the effects of an intervention combining mirror therapy and MP initiated during the acute phase of cerebral infarction. [Participant and Methods] A female patient >80 years of age with a cerebral infarction was studied. Prior to cerebral infarction, the patient was independent in her activities of daily living. [Results] As a result of MP, sufficient improvement was observed in the upper extremity function on the paralyzed side, as assessed using the Fugl–Meyer Assessment (FMA) and Motor Activity Log (MAL). [Conclusion] In patients with MP initiated during the acute stroke phase, a combination of mirror therapy and action observation to enable vivid MI may elicit a more significant intervention effect.

Key words: Mental practice, Mirror therapy, Stroke

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INTRODUCTION

Mental practice (MP) is a method of rehabilitating upper extremity function on the affected side of the body post-stroke, aiming to improve performance in motor tasks through sustained repetition of motor imagery (MI). Systematic reviews have found MP to be effective for patients with stroke[1, 2]. Accordingly, the level of evidence for MP has been graded as A in American Heart Association guidelines[3].

However, the methodology of MP is inconsistent in practice, with variations in time of MP initiation, duration, and conduction in different studies[4, 5]. Furthermore, MP is started during the chronic phase of stroke in most studies, with few reports having examined its effects in patients in the acute or sub-acute phases of stroke[6]. This scarcity of research may be because effects of specific approaches are difficult to verify in the acute phase of stroke, in which improvement in physical function involves a wide variety of factors, and impaired consciousness prevents patients from understanding MP instructions.

Examining the effects of MP intervention at various stroke phases, including acute, is important for investigating a suitable timing for MP initiation. Therefore, we performed and examined the effects of MP and mirror therapy at an early stage for a patient with acute cerebral infarction who presented with palsy.

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CASE PRESENTATION

A woman in her 80s presented to our hospital with complaints of nausea and weakness in the right upper and lower extremities upon arrival. Physical examination revealed right upper and lower extremity palsy, as well as dysarthria. Magnetic resonance imaging (MRI) revealed a 11 mm × 10 mm left pontine infarction. Prior to the cerebral infarction, the patient was independent in her activities of daily living (ADL). The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Juzenkai Hospital (protocol code, J2023-03).

Occupational therapy was initiated two days after the infarction and began with a focus on motor therapy, specifically extremity range of motion exercises and getting-out-of-bed training. On day seven, mirror therapy was started. In mirror therapy, the patient was instructed to actively flex and extend her unaffected hand in a mirror box at her own pace, and was prompted to actively flex and extend her affected hand as much as possible while visually confirming the mirror image of the unaffected hand. A single session of mirror therapy consisted of two 5-minute sets. MP was combined with mirror therapy from day 14 forward. The video shown of MI in MP was created with an iPad (Apple, Cupertino, CA, USA). The video was recorded with the iPad placed in a manner that would enable viewing from a first-person perspective. The patient was instructed to place her unaffected upper extremity on the table in a relaxed posture, and actively flex and extend her hand. The video was recorded with a horizontal flip function so that it appeared as if the patient was flexing and extending her affected hand while watching the video (Fig. 1). A single MP session consisted of three 5-minute sets with a 3-minute break between each set. The patient was instructed to perform MI as if her own hand was moving from a first-person perspective. From day 21, task-oriented training was combined with the abovementioned interventions; specifically, the patient practiced grasping and moving large, medium, and small balls, as well as round tubes.

On days 2 and 26 after the cerebral infraction, the patient's affected upper extremity function was assessed with the Fugl–Mayer Assessment (FMA) and the Motor Activity Log (MAL), cognitive function assessed using the Mini-Mental State Examination, and ADL assessed with the Barthel Index (BI). The patient demonstrated improvements in FMA and MAL after the intervention compared to baseline. Improvement was additionally observed in the BI, which assessed ADL (Table 1).

DISCUSSION

In this case study, we aimed to verify the efficacy of MP initiated shortly after stroke. FMA results revealed an improvement in the function of the affected upper extremity, while MAL results showed a slight improvement in the use of the affected upper extremity in daily living. These findings are in line with those of previous studies conducted with patients in the chronic phase of stroke, suggesting that MP is effective for improving the function of paralyzed upper extremities if initiated shortly post-stroke.

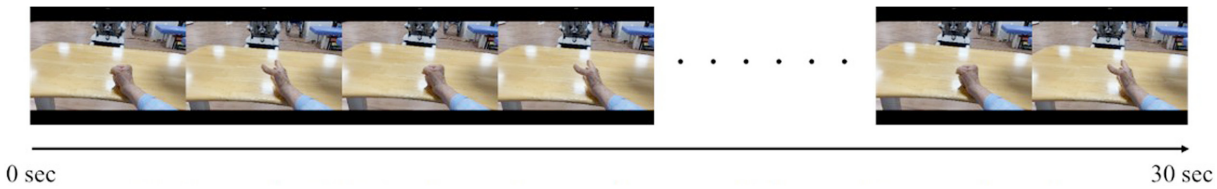

Fig. 1. Active hand flexion and extension were shown on an iPad screen during mental practice.

Table 1. Changes in indicators from baseline following intervention.

Test	Evaluate point	
	2 day	26 day
Fugl–Meyer assessment		
Category A	0	25
Category B	0	2
Category C	0	8
Category D	0	0
Motor activity log		
Amount of use	0	0.36
Quality of movement	0	0.29
Mini-mental state examination	29	29
Barthel index	5	60

Because impaired consciousness prevents patients from sufficiently performing MI in MP, and the effects of specific approaches are difficult to quantify in the acute and subacute phases of stroke, in which improvement in physical function involves a wide variety of factors (e.g., improvement in cerebral edema, diaschisis, and penumbra), few studies have initiated MP in the acute phase of stroke[7]. Previous studies starting MP for affected upper extremity function and gait roughly 30 days after stroke failed to demonstrate sufficient improvement[8, 9]; this may have been because patients with stroke suffer from reduced MI capacity. In fact, a previous study that compared MI performance between healthy individuals and patients within 21 days after a stroke reported an evident impairment in MI performance in the acute phase of stroke[10]. Thus, MP for patients in the acute phase of stroke requires an approach that can compensate for the effects of reduced MI performance.

In the present case, we initiated mirror therapy prior to MP to promote activation of the mirror neuron system with the aim of addressing such issue. The mirror neuron system, which refers to the function of a group of nerve cells that is activated when the movements of others obtained from various sensory information are flipped as if the individual were performing the movements themselves[11], is believed to be a mechanism in mirror therapy[12]. Thus, the intent of mirror therapy was to ensure enough MI performance to enable the patient to sufficiently imagine "movement of the affected upper extremity, which is actually paralyzed", while visually confirming the image reflected in the mirror. Vivid MI is crucial for effective MP[13]. In the present case, the combination of mirror therapy and MP may have elicited such an effect.

This case study was limited because we did not assess the patient's MI capacity. Even if MI capacity would have been difficult to assess with a questionnaire, such as the Movement Imagery Questionnaire-Revised[14], assessment with mental chronometry might have been possible[15].

In the present case, we demonstrated that MP can be initiated effectively in the acute phase of stroke in a patient who presented with cerebral infarction. In MP initiated in the acute phase, the combination of mirror therapy and action observation to enable vivid MI may prompt a greater intervention effect. In the acute phase of stroke, patients cannot voluntarily move the paralyzed upper limb due to the severity of motor paralysis and cannot perform adequate rehabilitation due to their general condition, which is unique to the acute phase. In this context, we believe that the benefits that MP can provide from the acute phase of stroke are valuable. However, the present report is a mere case study; case series and randomized controlled trials should build on our findings to examine the efficacy of MP initiated in the acute phase of stroke.

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Conflict of interest

The authors declare no conflict of interest.

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