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Original Article

Effect of action observation therapy on daily activities and motor recovery in stroke patients

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ARTICLE INFO

Article history:
Received 5 June 2015
Received in revised form
12 July 2015
Accepted 27 July 2015
Available online 18 August 2015

Keywords:
Action observation therapy
Activities of daily living
Mirror neuron
Stroke

ABSTRACT

Objective: To evaluate the effects of action observation therapy, which is based on mirror neuron theory, on upper limb function and activities of daily living in patients with stroke.
Methods: Sixty-one patients with stroke were randomly divided into two groups; those in the control group received routine rehabilitation treatment and nursing, whereas those in the experimental group additionally received eight weeks of action observation therapy for 30 min, six times per week. Patients receiving action observation therapy watched videos depicting a model performing specific motor actions typically performed in daily life before enacting the same actions themselves. All patients were assessed using the Fugl–Meyer assessment, Barthel index and the modified Ashworth scale at baseline and at eight weeks, after treatment.
Results: After the eight weeks of treatment, both groups of patients exhibited significant improvement in all the measurements (all $p < 0.05$). Furthermore, the Fugl–Meyer assessment, Barthel index and modified Ashworth scale scores were significantly higher in the experimental group compared to the control group (all $p < 0.05$).
Conclusion: Action observation therapy significantly improves upper extremity motor function and performance of activities of daily living, and alleviates upper limb spasticity in patients with stroke.

1. Introduction

In China, patients with stroke experience relatively slow and poor rehabilitation of their upper extremity function following hemiparalysis. For example, 55–75% of stroke patients have upper limb disorder, and only 38% have partial restoration of upper limb flexibility six months after the stroke [1]. This results in extreme disability in many patients, and severely limits their ability to perform daily activities. Rehabilitation therapy for the recovery of upper extremity function primarily includes constraint-induced movement therapy, traditional

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Peer review under responsibility of Chinese Nursing Association.
http://dx.doi.org/10.1016/j.ijnss.2015.08.006

hand function training methods, robot-based auxiliary rehabilitation training, functional electrical stimulation, joint training of both upper limbs and so on. However, such therapies require long-term, high-intensity one-on-one training with the therapist, which can be difficult for the majority of patients to complete.

A new type of rehabilitation therapy, called action observation therapy, has been developed based on the mirror neuron theory [2,3]. Mirror neurons are neurons in the brain that are activated both when an individual executes an action and when he or she observes another perform the same action. The goal of action observation therapy is to promote functional reorganization within the brain of stroke patients via activation of these mirror neurons in order to promote motor function recovery. A European study showed that the performance of daily living activities, upper extremity function and Ashworth score of stroke patients were improved by action observation therapy, thereby demonstrating the effectiveness of mirror neuron activation on functional recovery after stroke [4]. The aim of the present study was to compare the effects of action observation therapy with standard rehabilitation alone on upper extremity function and activities of daily living in hemiplegic patients with stroke in China.

2. Materials and methods

2.1. *Patient selection*

A total of 70 stroke patients who were hospitalized in our Rehabilitation Medical Centre between January 2013 and June 2014 were recruited for this study. This study was approved by the Hospital Ethics Committee.

Criteria for inclusion were: (1) patients who met the diagnosis for stroke formulated in the 4th National Academic Conference on Cerebrovascular Disease in 1995 [2], and were confirmed as having a stroke upon computed tomography or magnetic resonance imaging [5]; (2) first-episode patients who began rehabilitation therapy within 6 mo, for whom the sitting balance was ≥Level 1, and the Fugl–Meyer assessment (FMA) score was ≥15 for upper extremity motor function; (3) patients with a stable condition; (4) patients with a normal Kinaesthetic and Visual Imagery Questionnaire score; (5) patients who were 42–75 years of age; (6) patients who provided informed consent and were willing to participate in the study.

Exclusion criteria were: (1) patients with cognitive impairment Mini-Mental State Examination score of <24 in patients with a junior high school education or < 17 if illiterate; (2) patients with severe upper limb spasticity; (3) patients with severe bone joint malformation or myopathy; (4) patients with severe diseases of the heart, lung, liver, or kidney.

Patients eligible for inclusion in the study were divided into experimental and control groups based on a random number table. Patients failing to be treated for three consecutive times and those with an aggravated condition were excluded; thus, 61 patients in total were included in the statistical analyses (31 patients from the experimental group and 30 patients from the control group).

2.2. *Research method*

The Kinaesthetic and Visual Imagery Questionnaire was administered to all patients before and after treatment to determine and assess the specific operation method, procedure, time and intensity of the extremity rehabilitation. The evaluations were carried out by the same specialized nurse and rehabilitation therapist, who had undergone specific professional training, were unaware of the patient grouping status and did not participate in the treatment. Patients in both groups received conventional drug treatment, traditional physical therapy and occupational therapy for 2–5 h, six times/wk for a total of eight weeks. The patients in the experimental group additionally received action observation therapy for 30 min, six times/wk for eight weeks.

2.2.1. *Action observation therapy*

For limb movement training, patients were asked to sit at a distance of 2 m from a colour television set and place their affected arm on the table. They were required to first watch a video showing a specific action of the upper limb and then perform the same exercise after watching (Fig. 1). A total of 30 action videos were used, which depicted the same model performing the following: the bending and extension, abduction and adduction, and pronation and supination of the shoulder joint, shrug and adduction of the scapula, bending and extension of the elbow joint, bending and extension, ulnar deviation and radial deviation of the wrist joint, warping of a thimble, empty-handed grabbing, catch and release of large and small balls, cubes and cylinders, holding and release of a coin and a key, handling of an IC card, pen, chopsticks and computer mouse, screwing of a jar lid and narrow-mouthed bottle cap, typewriting, dialling on a mobile phone, grasping and release of a spoon, feeding training, and putting on clothes (including use of a zipper and button).

Each video was approximately 50 s in duration and depicted an action as seen from straight on (20 s), right above (15 s) and right inside (15 s); the complete action was recorded 2–3 times at each angle. Each action video was numbered according to the difficulty level of the action (1 = easiest, and 30 = most difficult). Videos with similar difficulty levels were

Fig. 1 – Action observation therapy.