Improving Cognitive Function in Patients with Stroke: Can Computerized Training Be the Future?

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Background: Cognitive impairment after stroke is common and can cause disability with a high impact on quality of life and independence. Cognitive rehabilitation is a therapeutic approach designed to improve cognitive functioning after central nervous system's injuries. Computerized cognitive rehabilitation (CCR) uses multimedia and informatics resources to optimize cognitive compromised performances. The aim of this study is to evaluate the effects of pc cognitive training with Erica software in patients with stroke. *Methods:* We studied 35 subjects (randomly divided into 2 groups), affected by either ischemic or hemorrhagic stroke, having attended from January 2013 to May 2015 the Laboratory of Robotic and Cognitive Rehabilitation of Istituto di Ricerca e Cura a Carattere Scientifico Neurolesi in Messina. Cognitive dysfunctions were investigated through a complete neuropsychological battery, administered before (T0) and after (T1) each different training. *Results:* At T0, all the patients showed language and cognitive deficits, especially in attention process and memory abilities, with mood alterations. After the rehabilitation program (T1), we noted a global cognitive improvement in both groups, but a more significant increase in the scores of the different clinical scales we administered was found after CCR. *Conclusions:* Our data suggest that cognitive pc training by using the Erica software may be a useful methodology to increase the post-stroke cognitive recovery. **Key Words:** Cognitive rehabilitation—computerized training—neuropsychology—functional recovery.

Background

Stroke is one of the main causes of mortality in industrialized countries,[1] and the leading cause of adult long-term disability, often with significant gait and upper limb impairment.[2]

The prevalence of poststroke cognitive dysfunction varies from 23% to 55% within 3 months from stroke onset, and declines between 11% and 31% after 1 year.[3-5]

Most stroke patients may live with specific cognitive deficits, including attention and concentration,[6] memory,[7] spatial awareness,[8] perception,[9] praxis,[10] and executive functioning[11] alterations with a significant reduction in daily life autonomy and quality of life.

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The typical clinical strategy of recovery in patients affected by stroke is to minimize the initial damage and thereby to improve the amount of functional recovery. Following stroke, it is possible that recovery could spontaneously occur, and improvement in neuropsychological functioning is generally observed for at least 2 years after brain injury. Indeed, Robertson and Murre indicated that there are 3 groups of recovery likelihood: spontaneous recovery, assisted recovery, and no recovery.[12]

Rehabilitative treatment, through integrative approaches, should allow a shifting from the simple remediation/compensation dichotomy to a more valid skills transfer and generalization.

Cognitive rehabilitation (CR) is becoming a standard component of neurorehabilitation after stroke, given that there is important clinical and research evidence of efficacy in improving cognitive and psychosocial functioning in patients with brain injury.[13,14]

CR refers to 2 major categories of techniques, that is, traditional and computer-assisted, computer-assisted cognitive rehabilitation (CCR).

In both cases, the cognitive training implements the residual neuropsychological abilities through specific strategies based on cognitive models. In particular, CCR uses multimedia and informatics resources with specific hardware system and software, to implement the cognitive training[15,16] for memory,[17] attention,[18] problem solving, and job simulation,[19] language,[20] praxis,[21] and processing speed.[22] Some clinical trials for stroke patients with neuropsychological deficits showed that the experimental group (performing computerized training) had a greater improvement than the control group (performing only conventional treatment, i.e., pen-and-paper exercises) in different cognitive domains, such as attention, memory, visual, and auditory learning.[23]

The aim of this study is to evaluate the effect of CCR, by using the software Erica, on cognitive and daily life performance, in stroke patients with cognitive impairment.

Material and Methods

Study Population

Thirty-five patients (mean ± SD age: 43.15 ± 16.85 years; 48.57% female) were enrolled in this study and randomized into either the control (CG: n = 15) or the experimental (EG: n = 20) groups. A more detailed description of the 2 groups is in Table 1.

The patients were randomly assigned to 1 of 2 groups (experimental or standard treatment) in order of recruiting.

This clinical, single-blind, randomized trial involved 35 stroke participants. All the patients needed CR based on medical and neuropsychological team's diagnosis. The sample was enrolled from January 2013 to May 2015 at the Laboratory of Robotic and Cognitive Rehabilitation of Istituto di Ricerca e Cura a Carattere Scientifico Neurolesi of Messina. The study was approved by the Local Ethical Committee. No participant was excluded from the study. Either the patient or the legal representative were adequately informed about the study and offered their collaboration and written consent.

The patients enrolled were in a chronic phase (i.e., 3-6 months from the acute neurological event). The EG consisted of 20 participants (11 men and 9 women, with a mean age of 43.9 years ± 16.6), whereas the CG consisted of 15 participants (7 men and 8 women, with a mean age of 42.1 ± 17.7). As shown in Table 1 the 2 groups

Table 1. *Demographical description of the sample at the beginning of the study*

	Experimental	Control	All
Participants (N)	20	15	35
Age (y)	43.9 ± 16.6	42.1 ± 17.7	43.1 ± 16.8
Gender			
Male	11 (55.0%)	7 (46.7%)	18 (51.4%)
Female	9 (45.0%)	8 (53.3%)	17 (48.6%)
Interval from stroke			
Mean in months	3 ± 1	4 ± 1	3.5 ± 2
Etiology			
Ischemic	15	9	24
Hemorrhagic	5	6	11
Brain lesion site/side			
Cortical right	7	4	11
Subcortical right	5	5	10
Cortical left	5	3	8
Subcortical left	3	3	6
Education y)	1.3 ± 4.1	11.2 ± 4.4	11.3 ± 4.1

Continuous variables were expressed as mean ± standard deviation, whereas categorical variables as frequencies and percentages.