Research on Computer Assisted Cognitive Rehabilitation for Cognitive Dysfunction after Traumatic Brain Injury

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Abstract. Traumatic brain injury (hereinafter referred to as TBI) is one of the world's leading causes of disability and death, which has become the main cause of affecting people's health all over the world. TBI will cause cognitive impairment (hereinafter referred to as CI), including memory impairment, disorientation, language impairment, impaired visuospatial ability, decreased computational power, decreased ability to judge and solve problems, which requires us to continuously improve the rehabilitation training of patients. With the rapid development of computer technology, computer-aided cognitive function training has been applied to the rehabilitation training of traumatic brain injury, which can train the cognitive ability of patients. Through the combination of computer ability and rehabilitation training methods, we can form a set of rehabilitation training mode. In this paper, the combination of computer-assisted cognitive rehabilitation program can be better.

Keywords: Computer Assisted, Cognitive Therapy, Traumatic Brain Injury, Cognitive Dysfunction

1. Introduction
TBI is a global public health problem. The annual incidence rate of TBI in city is 59.7/10 million [1]. With the improvement of diagnosis and treatment technology, the mortality of TBI decreased significantly. However, TBI patients will be left with CI, which will affect the ability of daily life of patients [2-3]. Cognitive dysfunction is a common sequelae of traumatic brain injury, including attention loss, memory loss, visual space disorder, aphasia and other symptoms. Rehabilitation training can improve the self adaptability of TBI patients, which can help to repair their own function and structure. Through early rehabilitation training, we can help patients recover memory, orientation and other functions, which will form a virtuous circle [4]. Therefore, rehabilitation training can help patients wake up their rehabilitation belief. Therefore, computer assisted cognitive rehabilitation (hereinafter referred to as CACR) has become a new treatment, which is a kind of rehabilitation training integrating computer technology [5]. Through computer-assisted cognitive rehabilitation, TBI patients can better carry out the rehabilitation of CI, including near far memory, computational power, speech, visuospatial power, perception, attention, executive power and so on [6]. By promoting
rehabilitation treatment, TBI patients can be better applied to the rehabilitation of CI. Through CACR, we can improve the health literacy of the whole people, which will improve and strengthen the construction of rehabilitation service system [7].

2. Rehabilitation training for CI
There are many methods of cognitive dysfunction rehabilitation training, as shown in Figure 1.

2.1. Rehabilitation training for attention disorder
We can carry out rehabilitation training by training patients' attention, which can include a variety of ways, such as guessing game training, sense of time training and number training. With the help of rehabilitation teachers and nursing staff, TBI patients can receive professional training, which will enhance their attention.

2.2. Rehabilitation training for memory impairment
Memory training is a common sense treatment, which can be widely used in life. The rehabilitation therapist or family members can simply ask the patient what daily activities they had yesterday, or ask the patient to name the nursing staff they often see. Through a short test, TBI patients can actively recall what happened yesterday, which will improve their memory.

2.3. Rehabilitation training for executive dysfunction
We can train the comprehensive analysis ability of the patients, which can let the patients read the newspaper or carry out simple garbage sorting. Then we can ask the patient about the information that appears in the newspaper. Through the training of comprehensive analysis ability, we can improve the analysis ability of patients, which can let patients master the necessary common sense in life. In the process of rehabilitation training, the rehabilitation teacher and nursing staff must take step by step as the training principle. At the beginning of the training should not be too difficult, and the training content should be as close to daily life as possible, which can let patients master life knowledge in the training. In addition, we should encourage patients and their families to participate together, which can help patients gradually recover their cognitive function under the warmth of their families.

2.4. Computational ability training
There will be a variety of problems in the calculation ability of TBI patients. Therefore, we can use the simple operations in our daily life to train our computing ability. At the same time, the difficulty of
calculation should not be too big, which can prevent patients from rebellious psychology. If the patient resists the calculation ability training, we should reduce the difficulty or suspend the training in time.

3. CACR of CI

3.1. CACR software
Computer aided cognitive system developed earlier in Europe and America, which has many different types of software, such as REHACOM, attention process training-3, Lumosity, Parrott, Cogmed QM, cogniplus and thinkable. Therefore, our rehabilitation training system mainly introduces foreign CACR system. Through rehacom cognitive training system, patients will significantly increase MMSE score, LOTCA score and FIM score. With the development of CACR system in China, it has achieved initial results. Through the OT soft software training experiment developed by Changgeng hospital in Taiwan, we can find that the effect of thinking operation test after computer training is significantly better than that of manual training. According to the results of cognitive research, Biwang technology company has developed zm3.2 system, which can be used for cognitive rehabilitation training of TBI cognitive training.

3.2. Cognitive rehabilitation and neural network reconstruction
FMRI is a noninvasive method to evaluate neuropathology. After traumatic brain injury, the assessment of CI will play an increasingly important role, which will become the main means to observe the changes of brain activity before and after cognitive training. At present, cognitive rehabilitation and neural network construction are mainly divided into DMN, SN and CEN. DMN is mainly composed of PCC, mPFC and in IPL. DMN was negatively activated during external tasks. In performing tasks related to internal psychology, we can be positively activated. TBI can cause the decrease of DMN connectivity, which will lead to the decrease of attention. SN is mainly composed of anterior cingulate gyrus, accessory motor area and anterior insula. Sn can inhibit DMN network activity, which will produce inhibition response. DLPFC is a key node in CEN, which is considered to be involved in top-down control related to working memory and executive control. In the process of cognitive tasks, CEN usually shows over activation. Each individual network plays a key role, but the effective interaction of these nodes requires the integrity of the connections within and between the networks. Many studies have shown that CI in TBI patients is associated with impaired connectivity among DMN, SN and CEN.

4. Analysis of experimental results

4.1. Materials and methods
Methods 82 patients with CI in our hospital from 2017 to 2019 were selected as the research objects. 60 cases in the control group and observation group were randomly selected. The average age was (53.6 ± 9.2) years.

4.2. Statistical method
By SPSS software, we process the data, we can use the measurement data to (x ± s) and t-test, and P < 0.05 for statistical significance.

4.3. Cognitive function score
The cognitive ability of the observation group was better, and the difference was statistically significant (P < 0.05), as shown in Table 1.
Table 1. The cognitive function scores

|                              | Social cognitive ability | Self care ability | Sphincter control | Comprehensive ability score |
|------------------------------|-------------------------|------------------|------------------|---------------------------|
| Observation group (n = 30)    | 19.9 ± 1.8              | 39.2 ± 4.0       | 19.9 ± 1.5       | 119.2 ± 5.8               |
| Control group (n = 30)       | 14.8 ± 1.8              | 25.8 ± 4.0       | 14.7 ± 1.5       | 92.2 ± 5.7                |
| T value                      | 4.329                   | 6.562            | 5.788            | 7.312                     |
| P value                      | 0.037 4                 | 0.010 4          | 0.016 1          | 0.006 8                   |

4.4. Rehabilitation indicators
Before treatment, there was no significant difference between the two groups. We can determine the rehabilitation indexes of the observation group. The difference was statistically significant (P < 0.05), as shown in Table 2.

Table 2. The rehabilitation indexes

|                          | MMSE | MOCA | LOTCA |
|--------------------------|------|------|-------|
|                          | Before | After | Before | After | Before | After |
| Observation group (n = 30)| 24.30 ± 2.44 | 29.50 ± 2.62 | 18.70 ± 3.88 | 26.50 ± 2.24 | 71.40 ± 10.48 | 85.50 ± 12.26 |
| Control group (n = 30)   | 24.45 ± 2.38 | 26.08 ± 2.66 | 18.68 ± 3.92 | 21.28 ± 2.96 | 71.38 ± 10.38 | 75.48 ± 13.06 |
| T value                  | 0.0079 | 4.1064 | 0.0146 | 4.1033 | 0.0078 | 5.6250 |
| P value                  | 0.9291 | 0.0427 | 0.9039 | 0.0427 | 0.9297 | 0.0177 |

4.5. BI and FM
There was no significant difference between the two groups. After treatment, compared with the control group, the BI and FM scores were significantly higher. The difference was statistically significant (P < 0.05), as shown in Table 3.

Table 3. BL and FM were compared

|                  | BI | FM          |
|------------------|----|-------------|
|                  | Before | After | Before | After |
| Observation group (n = 30) | 29.40 ± 3.22 | 45.30 ± 3.88 | 32.70 ± 3.18 | 52.48 ± 4.11 |
| Control group (n = 30)     | 29.25 ± 3.30 | 37.05 ± 3.79 | 32.68 ± 3.26 | 46.14 ± 4.02 |
| T value                | 0.029 3      | 4.336 0    | 0.014 4   | 4.867 3    |
| P value                | 0.864 1      | 0.037 3   | 0.904 3   | 0.027 3    |

5. Conclusion
According to the experiment, CACR has obvious effect, which can better help patients with cognitive function rehabilitation. People should carry out cognitive rehabilitation training as soon as possible, which can promote the recovery of CI. By controlling the disease, we can improve the quality of life of patients, which will achieve the ideal rehabilitation effect.

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