A Multimedia Holistic Rehabilitation Method for Patients after Stroke

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\textbf{Abstract}. The rehabilitation of patients after a stroke must provide polisensoric cognitive therapy. A specially designed computer/information system suits well to these requirements and offers a complementary and holistic treatment, which can be used in a rehabilitation center and later at the patient’s home.

\textbf{Keywords}. stroke, aphasia, rehabilitation, multimedia rehabilitation, cognitive function, cognitive rehabilitation

\section*{Introduction}

Special care is needed for patients who have experienced a stroke. Rehabilitation procedures must improve the patient’s cognitive functions, reduce somatic influence of paresis, and often provide a kind of logopaedic help for people suffering from aphasia or dysarthria. Dedicated computer systems equipped with proper software to support rehabilitation process are very helpful in a cognitive rehabilitation, which requires the polisensoric stimulation of a patient’s brain. Research in this field is still in progress \cite{1,2} including implementations of virtual reality environment \cite{3,4}.

In this paper we describe a multimedia rehabilitation method developed in our medical center, exercises implemented in the computer system (equipped with special devices) and their application in stroke patients. Preliminary results obtained by using standard tests are presented as well.

\section*{1. Multimedia rehabilitation method}

The proposed multimedia rehabilitation method consists of:
\begin{enumerate}
  \item diagnostic phase,
  \item main rehabilitation process and intermediate results assessment phase (this phase uses a specially developed multimedia computer system),
  \item final result assessment phase,
  \item and optionally – remote patient rehabilitation.
\end{enumerate}

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During the first phase each patient follows an individual diagnostics process. Its results inform about nature and depth of cognitive dysfunctions. It helps to choose exercises best suited to patient’s needs.

Several exercises are designed and implemented which are targeted at different types of disabilities:
1. logopaedic exercises for patients with aphasia,
2. exercises improving the dexterity of a hand,
3. cognitive exercises.

Additionally, many exercises are designed to allow simultaneous rehabilitation of more than one dysfunction. Every patient can have an individually chosen set of exercises (so called “training”) where interleaving exercises assure improvement in brain functions.

In the second phase a patient is trained by prescribed complementary exercises. The results of exercises are stored in a central computer database. This data is analyzed to assess patient’s progress and to alter exercises.

In the third phase, an individual and general rehabilitation score of a patient is obtained using a computer program and the standard methods of measuring the rehabilitation results.

The optional fourth phase allows for extending the patient’s rehabilitation at home. This phase is proposed for selected patients only, based on the results achieved in the previous phase [2].

2. Results

In Table 1 we present some preliminary results obtained with the standard psychological tests, prior to and after the rehabilitation process.

The results of rehabilitation of the patients with concentration and memory dysfunction are presented in the upper part of Table 1. Tests were conducted on a group of twelve persons with left and right-sided stroke, six men and six women with average age of 51. The standard medical test MMSE (Mini Mental State Examination) was used to grade the effect of rehabilitation. The MMSE attempts to quantify the patients’ capabilities in five fields: orientation, registration, attention and calculation, recall, and language. The maximum score in this test is 30 points. The results below 23 indicate the disturbance of cognition. We observed a two point (7.6% of initial value) improvement in the general score and a one point (18%) in the attention field.

<table>
<thead>
<tr>
<th>Table 1. Effects of rehabilitation</th>
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<tr>
<td>Patients with concentration and memory dysfunctions (before/after)</td>
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<tr>
<td>Mini Mental State Examination</td>
</tr>
<tr>
<td>general score (max 30)</td>
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<tr>
<td>23.6/25.4</td>
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<tr>
<td>Aphasic patients (before/after)</td>
</tr>
<tr>
<td>motor aphasia (Broca)</td>
</tr>
<tr>
<td>expression (max 106)</td>
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<td>73.0/94.3</td>
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</table>
To examine the cognitive processes of the patients with brain damages, selected parts (visual and auditory memory) of Włodzimierz Lucki’s package [5] were used. The two point (28%) improvement regarding visual memory and the 0.6 point (12%) one regarding auditory memory were observed. Alexander Luria’s learning curve indicates one point (56%) recovery.

In the lower part of Table 1, the results of rehabilitation of the aphasic patients are shown. The tests were conducted on a group of twenty-one persons with left-sided stroke, thirteen with motor aphasia and eight with mixed aphasia, seven women and fourteen men with average age of 59. In this case of Włodzimierz Lucki’s package of tests in two main categories: language expression and understanding was used. The patients with Broca’s aphasia demonstrated a twenty-one point (29%) improvement in expression and about seven (7%) in understanding. The sensorimotor aphasia patients achieved a twenty-point (46%) recovery in expression and the ca. fifteen one (44%) in understanding.

3. Conclusions

A polisensoric rehabilitation performed with the aid of the specially designed computer system offers a complementary and holistic treatment of patients after stroke. It better stimulates the brain plasticity and speeds up the regeneration after injury.

The average results of rehabilitation of the patients with concentration and memory dysfunctions are not very satisfying due to the severity and location of stroke, character of dysfunction, and weak motivation for performing exercises. The results of rehabilitation of the aphasic patients are quite good and stable.

The results presented are preliminary. We plan to continue the tests and to compare the proposed rehabilitation methods with the traditional ones. We also are going to introduce new exercises to amplify the holistic rehabilitation process.

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References

Optimizing Clinical Training for the Treatment of PTSD Using Virtual Patients

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Abstract. Adequate treatment of PTSD is a growing concern for the military. However, there is a shortage of qualified personnel available to apply this treatment. Virtual patient systems offer a novel technology to enhance the training needs of such health providers. This pilot project builds on previous work done with virtual patients and describes a novel scenario wherein a virtual patient is immersed within an exposure therapy simulation while a clinician interacts and guides the virtual patient through the recovery process using exposure therapy for PTSD. While this work is ongoing, preliminary results will be presented.

Keywords. Virtual Reality, PTSD, Exposure Therapy, Training, Virtual Humans

Introduction

In recent years, the US Department of Defense has made a rapid and intense effort to fund the development, documentation, and dissemination of efficacious treatment methodologies for posttraumatic stress disorder (PTSD) and traumatic brain injury (TBI). During the past decade, approximately 1.64 million U.S. troops have been deployed for Operations Enduring Freedom and Iraqi Freedom (OEF/OIF) in Afghanistan and Iraq. A recent RAND report discusses the psychological impacts resulting from these deployments, in which many soldiers experience prolonged exposure to combat-related stress over multiple rotations [1]. Unfortunately, the effective deployment of evidenced-based clinical treatment has been limited by a shortage of properly trained clinicians. This shortage is particularly notable for exposure therapy as expert consensus guidelines recommend it as the first line treatment for PTSD. Exposure to emotional situations and prolonged rehearsal result in the regular activation of cerebral metabolism in brain areas associated with inhibition of maladaptive associative processes [3]. Identical neural circuits have been found to be involved in affective regulation across affective disorders [4]. Systematic and controlled therapeutic exposure to phobic stimuli may enhance emotional regulation through adjustments of inhibitory processes on the amygdala by the medial prefrontal

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