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# COMPUTER-ADMINISTERED COGNITIVE REMEDIATION IN A FRAME OF HOLISTIC NEUROPSYCHOLOGICAL REHABILITATION: FORAMENREHAB PROGRAMS

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## **ABSTRACT**

Cognitive rehabilitation is traditionally considered an important part of rehabilitation of the brain injured patients. However, new viewpoints for the cognitive rehabilitation are to be set. The continuous challenge to neuropsychology is to develop new methods for assessment and rehabilitation, and the critical evaluation of these methods. Neuropsychological rehabilitation should address many facets of a brain injured individual, treat him or her in a holistic frame of reference with appropriate techniques and strategies for cognitive, emotional, and societal skills while increasing awareness and understanding of the new self [1]. According to the recommendations of evidence-based studies, computer-based interventions that include active therapist involvement to foster insight into cognitive strengths and weaknesses, to develop compensatory strategies, and to facilitate the transfer of skills into real-life situations may be used as part of a multi-modal intervention for cognitive deficits [2]. FORAMENRehab -cognitive software, developed by our team, is a tool for cognitive rehabilitation to be used as a part of a holistic neuropsychological rehabilitation approach. The programs are based on the models and theories of brain functioning and recovery. The first FORAMENRehab module is designed for the disturbances of attention. The next modules are planned for the disturbances of memory, visual perception, and problem solving. The first clinical experiences of the applicability of FORAMENRehab software in Finland with traumatically brain injured and stroke patients have been promising.

## **COGNITIVE SEQUELAE AFTER TRAUMATIC BRAIN INJURY**

Traumatically brain injured patients frequently have cognitive, emotional and behavioural deficits with difficulties in establishing interpersonal relationships and returning to productive life. Impairments of cognitive functions are a significant cause of disability after brain injury.

The cognitive functions emerge as a result of several functional subsystems working together. They include the discrimination between and selection of relevant information, acquisition of information, understanding and retention, and the expression and application of knowledge in the appropriate situation.

Cognitive disabilities may be seen in functions such as attention and concentration, perception, learning and memory, executive functioning and problem-solving, language and communication, and praxis. Cognition or cognitive deficits can not be defined without the concepts of emotion and motivation [3,4].

## **COGNITIVE REHABILITATION IN A HOLISTIC PERSPECTIVE**

Neuropsychological rehabilitation should address many facets of a brain injured individual, treat him or her in a holistic frame of reference with appropriate techniques and strategies for cognitive, emotional, and societal skills while increasing awareness and understanding of the new self [1]. The main elements of the holistic programs include the promotion of therapeutic community, cognitive retraining and psychotherapy carried out in individual and group settings, supported work or educational trials, family education and therapeutic assistance, as well as follow-up procedures. The effectiveness of systematic and holistic neuropsychologically oriented TBI-rehabilitation programs in enhancing patients' productivity status has been supported by uncontrolled studies and a few studies with control groups [5,6,7,8].

Cognitive rehabilitation is traditionally considered an important part of rehabilitation of the brain injured patients. Cognitive rehabilitation is defined as a systematic, functionally oriented service of therapeutic activities that is based on assessment and understanding of the patient's brain-behavioral deficits. Specific interventions may have various approaches, including practising and reestablishing the impaired functions; reinforcing the use of preserved functions; teaching cognitive compensatory strategies for impaired functions; establishing the use of external compensatory devices such as electronic memory aids; enabling persons to adapt to their cognitive disability by fostering insight and understanding into their cognitive strengths and weaknesses. Regardless of the form of intervention, the aim of cognitive rehabilitation is to improve the person's functioning in their everyday lives.

## **COMPUTER-ADMINISTERED COGNITIVE REHABILITATION**

The continuous challenge to neuropsychology is to develop new methods for assessment and rehabilitation, and the critical evaluation of these methods. To quote George Prigatano [1] "... new techniques for the remediation of disturbed higher cerebral functioning should constantly be under development, while still attending to patients' personal experiences and helping them adjust to their neuropsychological deficits in the context of interpersonal situations." According to the recommendations of evidence-based studies, computer-based interventions that include active therapist involvement to foster insight into cognitive strengths and weaknesses, to develop compensatory strategies, and to facilitate the transfer of skills into real-life situations may be used as part of a multi-modal intervention for cognitive deficits [2].

The computer-assisted methods focus on neuropsychological processes using computerized exercises that train different cognitive functions instead of traditional paper-and-pencil drill. However, there seems to be an obvious lack of theoretically and clinically based rehabilitation software worldwide. In Finland there has not existed any rehabilitation software of this kind in Finnish before the development of

FORAMENRehab -cognitive software by our team. This development project started in the middle of the 1990's and the first module was presented in December 2000.

## **FORAMENRehab -cognitive rehabilitation programs**

FORAMENRehab -cognitive software is a tool for cognitive rehabilitation to be used as a part of a holistic neuropsychological rehabilitation approach. The programs are based on the models and theories of brain functioning and recovery. In our own clinical practice the software is used systematically in the cognitive group of the INSURE-program (the Individualized Neuropsychological Subgroup Rehabilitation program for Traumatically Brain Injured Patients). The INSURE-program has been described in detail elsewhere [9]. It is a six-week post-acute holistic rehabilitation program for selective groups of traumatically brain injured patients. The core of the program is neuropsychological rehabilitation and psychotherapy. It is based on the work of George P. Prigatano, Yehuda Ben-Yishay, and Anne-Lise Christensen [10,5,7]. The goal of the cognitive group is to compensate for the cognitive symptoms. The practical significance of injury-related changes in information-processing skills, persistence, energy levels, attentional processes and reasoning is considered in terms of recovery, compensation and personal functional obstacles. Rehabilitation software and lectures are used to demonstrate cognitive changes and to make the logic of them clearly understandable.

FORAMENRehab software provides an easy to handle and efficient graphical user interface operating in Windows environment. The menu structure, toolbar and icons are illustrative and the help screens provide information, so the program is usable even without the help of the clinician. Each program has a clear written instruction on the screen as well as a model animation. The parameters of each program can be modified to adjust to a particular user. The results are presented both in written and graphical forms and can be printed. They can also be saved to file and compared with the previous results.

### **Attention module**

The first FORAMENRehab module is designed for the disturbances of attention. Traditionally the remediation of attention deficits have based on drill and practice, with exercises designed to focus on specific aspects of attention. The theories and models of attention propose several subsystems of attention. They include focused attention, sustained attention, divided attention, shifted attention, and alternating attention. Focused attention refers to the ability to focus on a particular stimulus. Sustained attention refers to the ability to maintain the focus. Divided, shifted, and alternating attention refers to the ability to alternate attention flexibly between targets.

Rehabilitation interventions should include training with different stimulus modalities, levels of complexity, and therapist activities providing monitoring and feedback [2]. FORAMENRehab attention module is based on these theories and models of attention and the findings of the studies of recovery of attentional deficits.

The next modules are going to be designed for the disturbances of memory, visual perception, and problem solving.

# Using the FORAMENRehab software



## Main user interface

Select a component of attention.

Available options are:

1. Focused attention
2. Sustained attention
3. Shifted attention
4. Tracking

Each component consists of several task applications.

The total number of modifiable task applications is 31.

## Task application interface

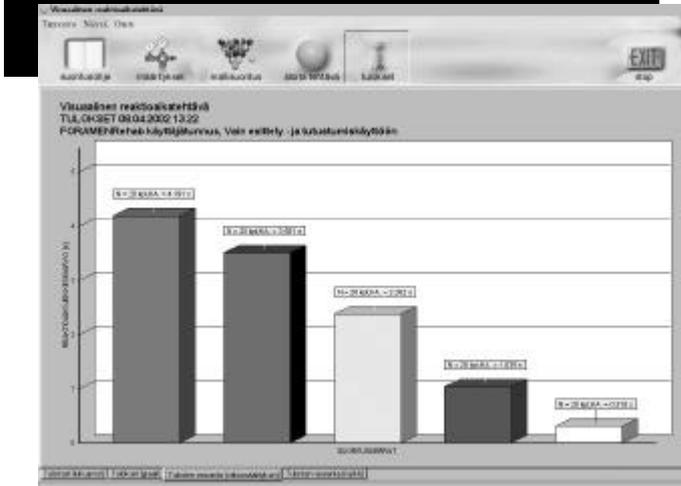
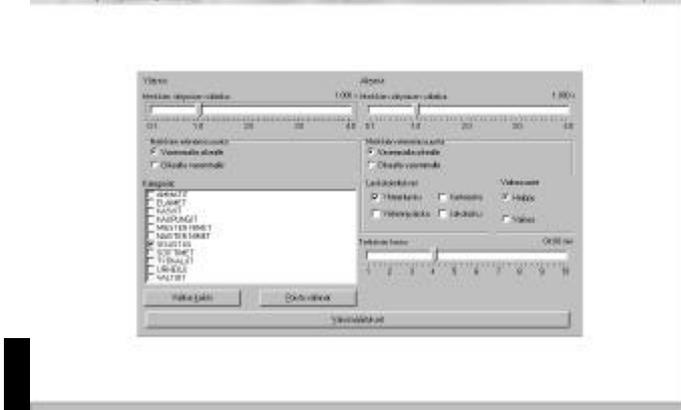
An example of the task applications Shifted Attention; Simultaneous Word Recognition and Arithmetic Task

1. Read the Task Instructions
2. Modify the Task Parameters (or use the Standard Parameters)
3. Take a look at the Model Performance (Animation)
4. Perform the Task
5. View the Task Results

The task performance data is presented as graphs and tables

The task results can be

- saved to a file or
- printed



FORAMENRehab software is also designed to cover other cognitive functions. The next module is for the disturbances of memory.

The first clinical experiences of the applicability of FORAMENRehab software in Finnish traumatically brain injured and stroke patients have been promising. A scientific study concerning the effectiveness of this computer based method for remediation of attention has been planned to start in the end of this year.

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