Web Service for Cognitive Remediation in Depression

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Abstract— **In the present paper, we describe a web service that provides cognitive remediation for patients with depression. Depression is reported to be frequently associated with alterations in memory, attention and cognitive flexibility. Cognitive remediation is based on training with tasks meant to foster neural plasticity and improve cognitive abilities. It is often applied using computerized tasks. We set up a web service that enables the patients with depression to practice on cognitive tasks and be guided by a specialized therapist. An exploratory study assessing this treatment is underway and case examples are presented here.**

Keywords-cognitive remediation; depression; tele-rehabilitation

I. INTRODUCTION

Major depressive disorder (MDD) is the most prevalent of all psychiatric disorders. By 2020, it is estimated to be the second leading cause of disability contributing to the global burden of diseases worldwide [1]. A Major Depressive Episode (MDE) is typically diagnosed by psychiatric interview based on symptoms enduring for two weeks or more: The individual will express acute sadness or experience significant loss of pleasure in occurrences that were previously enjoyable [2]. Other additional symptoms may be: significant weight loss or weight gain, insomnia or hypersomnia, psychomotor alterations (agitation or retardation), fatigue or loss of energy, feelings of worthlessness or excessive guilt, diminished ability to concentrate, recurrent thoughts of death and even actual attempts to commit suicide. In an epidemiological study, Lépine and colleagues [3] estimated to 6% the average risk for any individual of experiencing a MDE in the coming 12 months. The effects of depression on the ability to work are devastating, often resulting in large amount of lost workdays or even dismissal [4]. Moreover, depression is considered a chronic disease with almost two-thirds of the patients experiencing at least one recurrence during a 10 years period following the first episode [5]. The burden of depressive disorders on the healthcare system is therefore tremendous and strategies are needed to improve care.

Depression is often associated with cognitive deficits. Studies have reported alterations in executive functioning, which are functions involved in the control of goal-directed behaviors, such as planning, inhibition of inappropriate responses or updating information in working memory [6, 7].

Attention and memory impairments are also considered to be frequently associated with depression [8]. In the present paper, we describe a web service that provides specialized cognitive remediation for depression. Cognitive remediation refers to a category of therapeutic interventions based on the premise that regular sessions of drill and practice on cognitive tasks foster neural plasticity. Computers are reported to hold practical advantages for delivering cognitive remediation, as they provide structured, customizable and standardized tasks in a multimedia and stimulating environment [9]. To our knowledge, there have been very few studies on Computer Assisted Cognitive Remediation (CACR) in depression. Elgamal, McKinnon, Ramakrishnan, Joffe and MacQueen [10] tested a 10 weeks CACR in a controlled study including 24 patients with MDD. Their results showed improvements in attention, verbal memory, speed of processing and executive functions. Naismith, Redoblado-Hodge, Lewis, Scott and Hickie [11] administered a 10 weeks CACR to 8 patients with MDD compared to 8 patients in a waitlist group. Improvements in memory were found to be greater for the treatment group. The CACR that we present here differs from previous attempts, by offering the opportunity to train at home in addition to the sessions with a therapist.

II. DESCRIPTION OF THE WEB SERICE

The treatment procedure involves a 7 weeks training with cognitive exercises accessible though the web. The web service was created by a partnership comprising the psychiatry department of a hospital and a software company specialized in cognitive training applications. A therapist specialized in CACR is assigned to every patient and follows her/him throughout the entire intervention. One session a week is scheduled with the therapist in the hospital and the patient is advised to train on her/his own, at home, for at least 3 other sessions per week. Sessions are spread evenly over the week and last between 40 minutes and an hour. During the session held at the hospital, the therapist and the patient first review the progressions made during the previous week. They then analyze the patient's difficulties and the therapist suggests new cognitive strategies. On this base, they define the coming week's training program. The role of the therapist is thus essential to guide the patient in the remediation procedure. When the patient begins the treatment procedure, an account on the web service is created for her/him. The patient can then

access the web service from anywhere. The patient can view the current status of her/his performances on her/his account (Fig. 1). The web interface also includes a chart summarizing the training sessions with details about the dates, durations and the exercises performed. The same web pages are available to the therapist, who can thus remotely monitor the patient's progression. This information is highly valuable for evaluating the patient's compliance with the treatment.
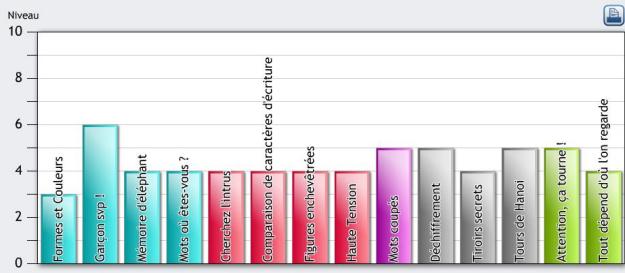

Figure 1.   Example of the current status of a user's performances on the various exercise available with the web service. The vertical axis represents the levels reached in the exercise displayed horizontally.

The web service application offers 14 different cognitive exercises, adapted from Scientific Brain Training Pro software (www.scientificbraintrainingpro.com), targeting verbal and visual memory, attention and vigilance, speed of processing, problem solving, verbal comprehension and visuospatial skills. The development process involved user tests with depressed patients for adjusting the exercises' difficulty. The user interface includes stress reducing stimuli (e.g. pictures of natural ponds) and the exercises were designed to be entertaining. For instance, a verbal memory exercise involves role playing as a waiter who has to remember the dishes ordered by clients (Fig. 2).
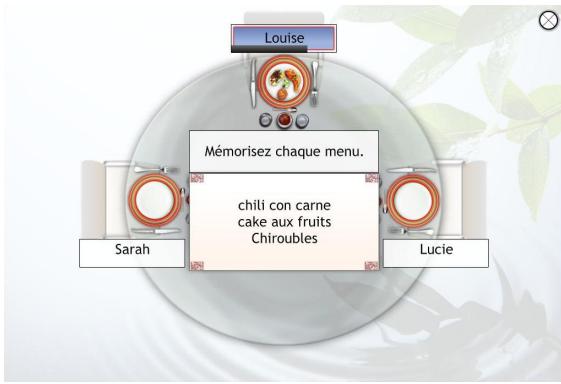
Figure 2.   Example of an exercise meant to train verbal memory, where the user is requested to remember a list of dishes ordered by virtual clients.

III.   PRELIMINARY RESULTS

We are currently conducting an exploratory pre-post design study to investigate the impact of the CACR intervention. As the study is still ongoing, the final results are not yet available, thus only preliminary observations are reported here. Seventeen participants have been recruited up to now. An informed consent was obtained from each of them. Only one participant decided to discontinue the treatment to date. The compliance indicated on the web service for the other sixteen participants has been satisfactory. Although depression is frequently associated with low motivation, the participants' willingness and acceptance of the treatment was beyond our expectations. For instance, a 72 years old patient that had been diagnosed with MDD and hospitalized was recruited into the study. He studiously carried out the training sessions at home, connecting to the web service almost everyday. Another patient, aged 51, would connect at least 4 times a week and his rate of connections remained stable throughout the intervention. A third patient, aged 51 also, showed similar constancy with an average of 3 to 4 sessions per week. These outcomes suggest that the web service may be equally beneficial for younger and older patients. In a whole, participants expressed satisfaction with the intervention. In future developments, for convenience of patients at a greater distance or having physical disabilities, we intend to combine this web service with videoconferencing, so that even the one session per week with the therapist could be carried out using Internet.

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