Rehabilitation of Memory and Executive Dysfunctions in Neurological Disorders

Essay
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Dedication

This work is dedicated to my mother, Dr Nagat A. Helaly who has inspired me throughout my whole life.
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AD</td>
<td>Alzheimer Dementia</td>
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<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
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<td>BADS</td>
<td>Behavioral Assessment of Dysexecutive Syndrome</td>
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<td>CA</td>
<td>Cornu Ammonis area</td>
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<td>CR</td>
<td>Cognitive rehabilitation</td>
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<tr>
<td>CSTC</td>
<td>Cortico-Striatal-Thalamic-Cortical</td>
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<td>CVLT</td>
<td>California Verbal Learning Test</td>
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<td>DES</td>
<td>Dysexecutive syndrome</td>
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<td>DEX</td>
<td>Dysexecutive Questionnaire</td>
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<td>DLPFC</td>
<td>Dorsolateral Prefrontal Cortex</td>
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<td>EF</td>
<td>Executive Functions</td>
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<td>EL</td>
<td>Errorless Learning</td>
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<td>FAB</td>
<td>Frontal Assessment Battery</td>
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<td>fMRI</td>
<td>Functional Magnetic Resonance Imaging</td>
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<td>GABA</td>
<td>Gamma Amino Butyric Acid</td>
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<td>GMT</td>
<td>Goal Management Training</td>
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<tr>
<td>IQ</td>
<td>Intelligence Quotient</td>
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<td>LTP</td>
<td>Long Term Potentiation</td>
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<td>MAS</td>
<td>Memory Assessment Scale</td>
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<tr>
<td>NMDA</td>
<td>N-Methyl-D-Aspartic Acid</td>
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<tr>
<td>PCA</td>
<td>Posterior Cerebral Artery</td>
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<td>PET</td>
<td>Positron Emission Topography</td>
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<td>RAS</td>
<td>Reticular Activating System</td>
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<tr>
<td>RBMT</td>
<td>Rivermead Behavioural Memory Test</td>
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<tr>
<td>TBI</td>
<td>Traumatic Brain Injury</td>
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<td>tDCS</td>
<td>Transcranial Direct Current Stimulation</td>
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<td>TMS</td>
<td>Transcranial Magnetic Stimulation</td>
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<tr>
<td>VC</td>
<td>Vanishing Cues</td>
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<td>VCI</td>
<td>Vascular Cognitive Impairment</td>
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<tr>
<td>VLPFC</td>
<td>Ventrolateral Prefrontal Cortex</td>
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<tr>
<td>VR</td>
<td>Virtual Reality</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>WAIS</td>
<td>Wechsler Adult Intelligence Scale</td>
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<td>WAIS-R</td>
<td>Wechsler Adult Intelligence Scale Revised</td>
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<tr>
<td>WMLs</td>
<td>White Matter Lesions</td>
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<td>WMS</td>
<td>Wechsler memory Scale</td>
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INTRODUCTION

The rehabilitation of disorders of cognitive functions (language, spatial perception, attention, memory, calculation, praxis), following acquired neurological damage of different aetiology (in particular, stroke and traumatic brain injury), is an expanding area of neurological rehabilitation, and has been the focus of considerable research interest in recent years (Hughes et al., 2006).

Cognition is defined as the process of knowing. It includes 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 disability may be seen in reduced efficiency, pace and persistence of functions, decreased effectiveness in the performance of routine activities of daily living; or failure to adapt to novel or problematic situations (Cicerone et al., 2011).

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. It has specific interventions including (1) reinforcing, strengthening, or reestablishing previously learned patterns of behavior; (2) establishing new patterns of cognitive activity through compensatory cognitive mechanisms for impaired neurologic systems; (3) establishing new patterns of activity through external compensatory mechanisms such as personal orthoses or environmental structuring and support; and (4) enabling persons to adapt to their cognitive disability. Cognitive rehabilitation may be directed toward many areas of cognition, including attention, concentration, perception, memory,
comprehension, communication, reasoning, problem solving, judgment, initiation, planning, self-monitoring, and awareness (Cicerone et al., 2011).

Memory impairment is a well-documented sequel following brain injury. Nearly a fourth of those who have sustained traumatic brain injury suffer from memory problems, and more than a third of patients who have suffered a stroke show cognitive impairments in one or more cognitive domains such as attention, memory, orientation, language, and executive functions. Generally, approaches to memory rehabilitation are either oriented towards restoring or optimizing damaged or residual functions, or focus on compensating for lost or deficient functions. Training techniques that have been investigated systematically include practice and rehearsal, domain-specific learning, mnemonics, and other strategies as well as the use of external memory aids and environmental supports (Hughes et al., 2006).

Moreover, several approaches to treating memory impairment were developed including spaced-retrieval, vanishing cues, procedural memory activation, and errorless learning. It has been suggested that these techniques are successful because they engage processes that lie outside of the declarative memory system and are related to spared memory functions e.g., implicit memory (Wilson, 2003).

Dysexecutive syndrome (DES) refers to a cluster of symptoms that people can show following damage to the cognitive processes that are supported mainly by the frontal lobe, resulting in difficulties in everyday life, such as problems with abstract reasoning, making decisions, and showing good judgment; difficulties in maintaining attention; inappropriate
social behavior; difficulties in devising and following plans; and difficulties with situations involving some forms of memory, e.g. remembering to carry out intended actions at a future time. It also include poor monitoring of one’s own performance and of changes in the environment with consequent problems in obtaining and utilizing feedback. As a result, individuals with the DES can present as impulsive, distractible, and unresponsive to cues from others, and behave inappropriately in social situations (Greenwood, 2003).

Cognitive interventions that promote internalization of self-regulation strategies through use of verbal self-instruction, self-questioning, and self-monitoring may be considered a practice option for the remediation of deficits in executive functions, including the reduction of problem behaviors in everyday situations (Cicerone et al., 2011).

Neuro-rehabilitation seeks to overcome the disabilities of neurologically impaired patients by looking for strategies to bring about functional improvement and amelioration of neurological deficits. The possibility of driving cortical plasticity with a view to neurofunctional gain has opened up a new dimension in the care of neurologically impaired patients and provides a creative new set of tools for the rehabilitation team (Wilson, 2003).
AIM OF THE WORK

The aim of this work is:

- To identify the different patterns of memory and executive dysfunction in neurological disorders.

- To review the different types of rehabilitation techniques for these dysfunctions in order to reach the best possible rehabilitation strategy.
Chapter One

Memory Functions and Dysfunctions

Introduction: In this chapter, a review of the different memory systems will be done. Also, an outline of memory dysfunctions in relation to neurological conditions will be reviewed.

MEMORY SYSTEMS

Memory function is critical to daily life, and includes a variety of specific abilities that enable information to be stored and retrieved over variable periods, ranging from seconds to days to years (Dickerson & Eichenbaum, 2010) and memory difficulties are one of the commonest cognitive problems arising from injury to the brain and, consequently, form a large part of cognitive rehabilitation (Wilson, 2003).

A memory system is a way for the brain to process information that will be available for use at a later time. Some systems are associated with conscious awareness (explicit) and can be consciously recalled (declarative), whereas others are typically unconscious (non declarative) and are instead expressed by a change in behavior (implicit) (Budson, 2009).

Declarative memory consists of two subclasses: episodic memory, which consists of memories for autobiographical events; and semantic memory, which consists of facts and general knowledge. Semantic memories are impersonal and devoid of autobiographical context, whereas episodic memories are personal. These include where and when episodes happened and are accompanied by a feeling of retrieving personally experienced episodes. Non declarative memory includes procedural learning.
of sensorimotor and cognitive skills and habits, priming, simple conditioning, and habituation and sensitization, all of which are expressed in behavioral changes (Henke, 2010). Figure 1 shows the different memory systems (Henke, 2010).

![Diagram of memory systems](image)

**Figure 1.** The declarative versus non-declarative memory (Henke, 2010).

Memory can also be classified according to different time spans into (a) Immediate or working memory (previous seconds) which is further subdivided into a phonological system (auditory information), a visuospatial (visual information), and a controlling central executive system, (b) Long-term memory which is divided into three classes: delayed (previous minutes), recent (previous days or weeks), or remote (previous years), and (c) Prospective memory which controls things that need to be done in the future while retrospective memory is for the past,