

# Cognitive rehabilitation and head injury

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## ABSTRACT

*The present study aims to present the cognitive benefits and the importance of the use of compensatory strategies for a better functional adaptation and for the quality of life in patient that underwent cognitive rehabilitation (CR), after a severe cranioencephalic trauma. A 24 years-old male carried out neuropsychological evaluation after eight months of car accident. CR program developed for one year and four months, with constant establishment of goal, cognitive training and use of compensatory strategies for the difficulties in the daily tasks. It is possible to notice through the neuropsychological reevaluation that the cognitive profits with the CR were global, including reaching expected performance for his age group in some functions. There was also observed, reach of great part of the stipulated goals, adaptation to the difficulties in the daily activities through the use of the strategies and consequently improves in the quality of life. This is a case that shows the contribution of the CR for patients who suffered CET, even after the process of spontaneous recuperation, in a moment that, from the clinical point of view, constant sequels keeps in mind.*

## KEYWORDS

*Cognitive rehabilitation, cognitive deficit, cranioencephalic trauma.*

## RESUMO

### **Reabilitação cognitiva no traumatismo cranioencefálico**

*O presente estudo tem como objetivo apresentar os benefícios cognitivos e a importância do uso de estratégias compensatórias, para uma melhor adaptação funcional e para a qualidade de vida, em um paciente que foi submetido à reabilitação cognitiva (RC) após um trauma cranioencefálico grave. Após oito meses do acidente automobilístico, um jovem de 24 anos foi submetido a uma avaliação neuropsicológica, iniciando-se, em seguida, um programa de RC. Este programa foi realizado durante um ano e quatro meses, com o treino cognitivo, o uso de estratégias compensatórias para as dificuldades nas tarefas diárias e com constante avaliação das metas. Foi possível observar por meio da reavaliação neuropsicológica que os lucros com a RC foram globais, alcançando o desempenho esperado para a sua idade em algumas funções cognitivas. Pode-se observar também o alcance de grande parte das metas estipuladas, melhor adaptação às dificuldades anteriormente apresentadas nas atividades diárias com o uso das estratégias e, conseqüentemente, melhora na qualidade de vida. Este é um caso que mostra a contribuição do RC para pacientes que sofreram TCE, mesmo após o processo de recuperação espontânea, em um momento que, do ponto de vista clínico, já seriam consideradas sequelas.*

## PALAVRAS-CHAVE

*Reabilitação cognitiva, déficit cognitivo, traumatismo cranioencefálico.*

## Introduction

The objective of cognitive rehabilitation (CR) is to increase spontaneous recuperation through cognitive stimulation, improving learning as a result of frequent repetitions. It is based on the concept of neuroplasticity, i.e., that the central nervous system is adaptable and able to recover from an injury through spontaneous adaptation and re-organize functionally to meet environmental demands.<sup>1</sup>

It is a relatively new concept and its application on clinical basis is often overlooked and neglected. The authors present a case of a patient who underwent CR with remarkable outcome.

## Clinical case

A 24 years old left-handed musician male was directed to neuropsychological evaluation after eight months of the head injury caused by traffic accident. He was attending the last year of law school with very satisfactory performance.

CT scan had showed right frontal and parietal cerebral injuries, suggestive of diffuse axonal injuries. He recovered from a post-traumatic coma and after one month he had started to present progressive improvement.

In the next eight months, patient stay at home, confused and with intense difficulties to perform daily

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activities, such as having a bath, brushing his teeth and incapacitating memories disorders.

The neuropsychological evaluation revealed global cognitive deficits, with great impact in praxis, executive functions, learning and memory (episodic, verbal and visual).

The CR goals defined with the patient and his relatives were mainly recognize and accept the difficulties, and re-adapt the patient to carry out important daily tasks, including take the medications by himself and be able to execute personal cares and improve reading and writing. Table 1 summarizes the CR clinical achievements and figures 1, 2 and 3 illustrate the functional gains.

With professional and familiar incentive, he returned to gymnastic and play music. He even tried to resume law school, unsuccessfully.

## Discussion

The CR process aims to support the patient in the recuperation and functional re-adaptation. It employs functional or compensatory neuropsychological strategies and the use of the preserved cognitive capacities. The main goal is to obtain a better functioning in the daily activities, and improve the quality of life.

The second stage of the process is the establishment of functional objectives that represent the main goal of the rehabilitation program. These goals are defined with the patient and relatives, and include behavioral and cognitive difficulties, related to daily activities in all fields: social, familial, school and professional.

The tasks carried out in the training resemble daily activities. The basis on CR is the learning without mistakes, and the degree of difficulty is increased only when the patient is able to perform appropriately the current level.<sup>1-5</sup>

*Table 1 – Summary of the functional outcome*

Cognitive functions		1st evaluation pre-rehabilitation	2sd evaluation post-rehabilitation	Outcome
Attention and motor functions	Extent attention	8	8	=
	Mental control	2	5	↑
	Sustentation	95"	82"	↑
	Shared attention	Could not make	Slowly could make	↑
	Inhibit control	33"4 mistakes	28"1 mistake	↑
	Mental flexibility	0 Categories	2 categories	↑
Visual functions	Identification	2 exclusion	1 exclusion	↑
	Visual synthesis	14 severe deficit	19 moderate deficit	↑
Constructive praxia	Complex image	17,5	25	↑
	3D image	3 of 3	3 of 3	=
	Clock draw	6 of 10	9 of 10	↑
	Visual construction	2	11	↑
Language	Nomination	53	58	↑
	Verbal proficience	28 with neologism	31 without neologism	↑
	Vocabulary	54	48	↓
	Lecture	Altered	Normal	↑
	Writing	Altered	Normal	↑
Learning	Verbal	6	6	=
	Visual	2	2	=
Memory	Daily activities	4	10	↑
		0	3	
		High involvement	Moderate involvement	
	Immediate verbal	11	15	↑
	Late verbal	3	6	↑
	Immediate visual	15	19	↑
	Late visual	0	5	↑

Better ↑ Same = ↓ Worst.

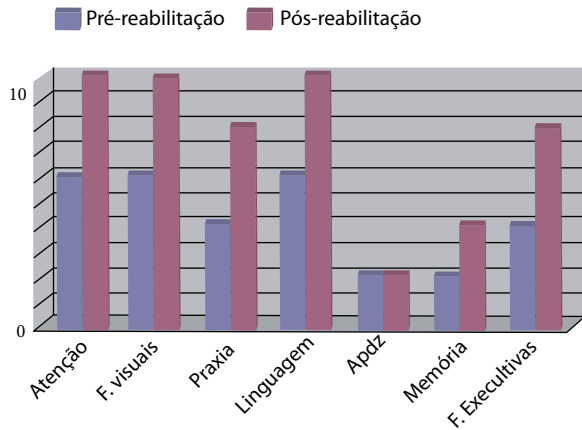


Figure 1 – Cognitive functioning before and after cognitive rehabilitation.



Figure 2 – Sequence carried out by the patient in the first evaluation, before the rehabilitation, with loss of the planning and repetitions.



Figure 3 – Sequence carried out in the second evaluation, after the rehabilitation, without loss of the planning and repetitions.

The compensatory strategies may be used and must reflect the generalization of the learning for the daily situations<sup>5</sup> and constitutes the biggest challenge of the process.<sup>2</sup> In more severe cases it is necessary the support of a relative, until the strategies are incorporated to the routine and patient can perform adequately.

It is important to emphasize that these strategies allow the patient to perform activities that depend on the changed cognitive functions. The main approach in this case is a better daily functioning and adaptation to the environment demands.

Several studies have shown that learning process increase the numbers of neurons. A repeat task activates various cortical areas and the repetitive training produces changes in synapses number and conexions.<sup>1-6</sup> Therefore, the learning process involves either cellular (neurons) and molecular levels, through the synthesis of proteins.<sup>1</sup>

According Persinger,<sup>3</sup> patients with cerebral injuries learn because the sparing neurons are activated; the learning of a new task is not a synonym of recuperation, however it necessarily reflects re-adaptation (Figure 4).



Figure 4 – Oil on canvas by a patient with attentional, executive and constructional praxis deficits after TCE and several sessions of cognitive rehabilitation.

From a functional recuperation standpoint, the early intervention may optimize the processes of natural and functional recuperation.<sup>2,4,5</sup> Spontaneous recuperation and the rehabilitation is more efficient in the first six months after head injury, however improvement and functional re-habilitation may still occur until two years after the cerebral injury. Nonetheless, the CR process should begin as soon as possible in order to maximize the clinical benefits.<sup>2-5</sup> Unfortunately, CR is often overlooked and its indication has often been neglected.

Besides early intervention, other factors, such as patient age, pre-morbid factors, type and gravity of the injury, extension of the deficits, the patient motivation for recuperation and familiar commitment affect neuropsychological outcome.

## Conclusion

This case demonstrates the benefits of the CR even after the process of spontaneous recuperation. The rehabilitation may bring cognitive benefits as well as adaptation to the difficulties in the daily activities. In this particular case, the improvements are more significant if the CR begins early after injury.

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