

Functional Neurosurgery and Neuro-cognitive Rehabilitation

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ABSTRACT

Cognitive rehabilitation is a group of designed techniques that is for the promotion of cognitive domains in people with disease or disability. Cognitive rehabilitation therapy (CRT) is the science of restoring cognitive processing and learning compensatory strategies and it affects the molecular and cellular recovery rehabilitation by integration of behavioral and cognitive changes. The promotion of rehabilitation science of cognitive neuroscience has made it a priority by the help of full range of effected interventional procedures. It has been able to achieve the desired goals in the chain of theoretical and experimental science on the basis of behavioral interventions which is made of neuroscience, cognitive neuroscience, psychology, physiology, pharmacology, medical imaging, and other medical disciplines and achieved some success in compensatory and medical strategies after surgery. Cognitive impairment after brain surgery is huge health challenges beyond the common disorders associated with diseases. Our approach to CRT is on the assumption that treatment would be the most effective way when focusing on the cognitive sub-systems after neurosurgery and these are also affected by other aspects of life as a patient emotions, nutrition, health, stress, and social performance. Intervention in the passive skills can lead to neuro-cognitive rehabilitation that includes designed experience on the basis of nerve and brain function and structure. A failure of cognitive or brain processing during or after surgery is an abnormal result and these impairments are treated better with CRT. This method is on the basis of neuroplasticity, reorganization of damaged cortical through morphological and physiological responses of nerve reconstruction ways by techniques in neuro-cognitive disorders due to illness, injury or disability, even in healthy individuals which are affected by environment, the complexity of stimulation, repeated tasks and motivation.

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INTRODUCTION

Early Cognitive Rehabilitation Techniques

The early attempts of CRT are not clear, some of the earliest recorded paper relate to the first world war and after it^{1,2}. Conducted assessments, including functional tests for psychological skill and performance are today considered by psychologists. This assessment was through measuring of concrete skills with a similar test which today is used in rehabilitation and skill training. Unlike many programs of this period, initial efforts in

CRT had not been focused on only learning, concentration and memory among patient with head injury³⁻⁵. Today many techniques of CRT have been originated from Luria techniques. Cognitive rehabilitation was individual neuro-cognitive functions, analysis of adaptive mechanisms and evaluation of spared skills which can resolve his/her defects. Generally the rehabilitation was a bilateral strategy which was designed for improving minor and compensatory skills of the patients with brain injury or psychotic symptoms. Then CRT was done with direct

training method^{6,7}. Alternative methods emphasize on training skills that a patient can use it in replace of damaged neural skills. Direct training methods include different forms that were designed to strengthen the patient mind and neural activity. The use of direct retraining approach was dropped and they re-direct methods, the potential for transmission of real-world limits. At the same time, CRT promotion was in brain injury rehabilitation^{8,9}. During the 1970s and 1980s the field of CRT experienced tremendous developments and grew rapidly by advances in cognitive psychology in 1960^{3,4}. CRT was formed with the most important ideas about neurological and cognitive disorders treatment among patients with pre or postoperative complications. Nowadays researchers of functional neurosurgery study on the effects of different types of rehabilitation techniques in the field of patients with cognitive impairments before and after surgery. They were more interested in CRT research and in the last years of the 20th century many suitable techniques of CRT, applicable and modeling programs were published.

Neuroplasticity Principles of Cognitive Rehabilitation Strategies

Cognitive rehabilitation therapy is based on neuroplasticity. Neuroplasticity of brain ability is for detecting and generating paths and circuits in response to our environment and more importantly in response to our thoughts. The brain has the ability to be changed during life and it is like a plastic. Recent investigations have shown that stem cells in the brain can cause the growth of new neurons in any age¹⁰. Neuroplasticity principles include attention, focus, intensity, duration, constraint, immersion, imitation and visualization. Focus causes some changes occur in the structure and organization of the brain¹¹. Brain chooses when to focus on our senses. Stimulating by focus on our senses enables the brain to be stimulated in certain areas. Neurons that are stimulated together are related with each other and these neurons create circuits and pathways in the brain and strengthen them. When two events occur simultaneously, they are related to each other in the brain and mind. For example, reading the word “patient” is a patient’s brain image visualization. Intensity/intense experience require very careful organization of the brain. Stimulation intensity will determine the way of evolution and growth of neurons. Nurturing stimulation and education levels are the most effective agents for positive effects. Duration of neuroplasticity events can play a role in rehabilitation which is short-term or long-term. Rapid expansion of brain maps and drawing occurs, remembering people

names in a meeting, learning fast for a test are of this kind. The long-term type which is for permanent effects may require several months and the effects are permanent. Brain maps and graphics are small in terms of size but the involved neurons are very efficient. When a patient is forced to use strong circuits, restrictions and enforcement/reorganization of the brain can be facilitated. And this patient should be able to classify the data again to use of weaker circuits¹². In Caused by brain damage from surgery, often patients can come back to their critical abilities. For example in the Brail readers see by using their fingers and when a patient loses his sight, force causes the vision loss, forcing the brain to make sense of the visual cortex allocated by touching the brail with fingers. Exposure to the equal opportunity has limitation and compulsion. Exposure in position can provide the necessary obligation for neuroplasticity. In imitation, mirror neurons cause the activation of same parts of viewers’ brain and this is done when they are looking at another one doing his work. Frontal lobe of the human brain prevents from actual engaging in activities. In children imitation, the action comes in more, because the frontal lobe of their brain has been less developed¹². This category provides more possibility of learning for patients. Embodiment is an activity that activates similar areas of the brain involved in doing actual activities. Skills can be upgraded and can only be strengthened through visualization¹², for example; surgeons imagine their activities before doing them. Neuroplasticity and reorganization of cortical damage by morphological and physiological reactions in nerve reconstruction techniques are the basis of neuro-cognitive rehabilitation and affected by the environment, stimulation complexity, repeated tasks and motivation.

Cognitive Rehabilitation Therapy

Stimulation therapy is perhaps the oldest method of CRT¹³. This type of therapy, was called as direct retraining based on the of cognitive functions development by stimulating cognitive systems. Treatment usually involves paper-and-pencil exercises and computer training that stimulates one or more mental skills and the patient’s daily activities will be in progress. Training process was another method and it is similar to the stimulation treatment but it is focused on specific parts of the recognition². In general, all methods of processing training are designed to improve certain aspects of cognition and some evidence suggests that cognitive skills improvement can ease the performance in other cognitive tasks. Treatment by Prosthetic-orthotic devices

is external tools which can resolve cognitive problems rather than retraining an incomplete processing. Although prosthetic devices do not remove the memory damages, they are one of the effective and useful treatment methods. Attention-concentration training is designed for improving the ability of a patient for focusing on attention, maintaining vigilance, resistance to distraction and effective and quick function of mental skills and this category is so important in CRT. CRT training strategy is mental domain training related to various fields of a patient^{14, 15}. Nutrients and drugs in the treatment of different materials can improve cognitive disorders with the correct chemical balance¹⁶. Domain-specific training method is a way in which a patient is stimulated for a function of cognitive specific domain. Then, the CRT of the computer simulations were used to train people for the data entry¹⁷. Indirect teaching techniques are based on the theory that, although the CRT method of direct way might be best for improving cognitive problems, indirect methods can also be effective. So they can have a better use of their reduced cognitive function^{18,19}. CRT with a focus on the sub-domain in a way that improves cognitive function more effectively, and we look upon this new approach to treatment.

CRT Evolution

CRT programs considerable interest in understanding brain function, and now must show that the treatment led to enhanced mental performance is unambiguous^{17,19-23}. Much researches in functional neurosurgery are associated with cognitive mapping system and in fact, internal and external interference that will affect their environment and includes a patient's brain function makes it easier. Changes in cognitive, behavioral, and social improved. Hence it shows the need for a modern approach to the CRT. CRT will show that the cognitive treatments led to enhanced cognitive and mental performance is unambiguous. These treatments are designed to primarily be on one aspect of rehabilitation treatment, and increase the focus on cognitive skills.

A Modern Approach to CRT

The goal is to help the patients to the highest level of cognitive functioning and functional independence for which it is possible to obtain one. Today, through innovative treatment programs, the best approach is performed by expert therapists. They are doing it in the following ways: Re-use strategies, skills compensatory education (CME in relation to cases where it does not), Consulting, environmental restoration, combining

education and job training opportunities, follow-up with patients who come to work and have followed his career and this could be the future of work, school or at home is even better. CRT is a vital part of the patient's treatment plan in neurosurgery department for functional neurosurgery assessment. Treatment was done in CRT centers and there promote on individual cognitive impairments. Program of cognitive rehabilitation therapy, is cognitive skills system. This method is designed primarily as a system of outpatient procedures. Ideally, CRT is a combination of rehabilitation programs that are being undertaken by the computer and on an outpatient basis, and those who stay at home, or in connection with the patients who visit the clinic will be held²⁴⁻²⁶.

Generally when a combination of internal and external interventions occurs the modern view to CRT becomes the most effective method. In fact this treatment was developed first to help the patients before and after surgery, but today it is for the treatment of cognitive disorders caused by brain injury, head trauma, spinal injuries, and brain tumors^{27,28}. Potentially the CRT can be helpful in elderly patients with cognitive challenges for self-sufficiency, self-care, keeping appointments and knowing others and remembering their names. In some cases, the CRT gives to the poor the learning ability of practical skills. Beside its use in cognitive rehabilitation disorders, CRT can be useful for students with learning disabilities. It is clearly possible to extent the use of CRT, but it is very new for research efforts to provide guidance in this area. Today, the effects of cognitive rehabilitation therapy, by using fMRI techniques are also studied and evaluated. Metacognitive strategies to be used include: To help raise awareness of their patients and consider solving skills, along with learning how to monitor the effectiveness of these skills and when necessary, to self-medicate. Computerized cognitive rehabilitation in recent years is one of the most effective treatments for cognitive rehabilitation therapy after neurosurgery²⁷⁻³¹. Neuro-cognitive rehabilitation is increasingly practical, methodological and theoretical advances have been made in neuroscience, cognitive neuroscience, pharmacology and medical imaging needs. Provide artificial limbs, "smart" nano-technology-dependent cell transplantation and neurological functions provide the ability to re-establish the proper experience optimal learning environments through the science of neuro-cognitive rehabilitation. Improve neurological functions using pharmacological interventions are likely to be accompanied by neurological rehabilitation interventions to achieve desired goals require. The emergence of

"basic science" neuro-cognitive rehabilitation relied on theoretical developments, methodological, and practical progress in basic neuroscience, cognitive neuroscience, pharmacology, medical imaging and other related fields.

CONCLUSION

The major challenge of neuro-cognitive rehabilitation is integration of behavioral and cognitive changes in rehabilitation and recovery of basic nervous systems and cellular and molecular changes caused by nerve damages after surgery or diseases. Integration of analysis levels in the early stages of a target for neuro-cognitive rehabilitation future is multi-level is multi-level intervention methods. The design of successful neuro-cognitive rehabilitation strategies in neurosurgery departments is due to the theories and models of nervous system function particularly efficient nature of its structure, function and response to the true experience. The relationship between gene expressions, cellular functions, neural circuits, functional networks, and behavioral outputs is a functional feature of a neuro-cognitive rehabilitation. Neuronal regeneration and synaptic connections of damaged areas are affected by the scope of the sensations which are the bridge between mind and body and help to the brain restoration. The CRT method can be used to stop or even reverse cognitive decline. Cognitive deficits have improved in patients; cognitive rehabilitation can be helpful in improving quality of life and reducing the risk of daily problems. CRT is also more widely available than previous years and neuro-cognitive rehabilitation should be a priority. We hope that this theoretical discussion provides many practical questions than answers in functional neurosurgery with CRT. We tried to use summarized research by providing practical treatment strategies. In most cases these are methods that have been successful for years. In most cases these are methods that have been successful for years. Our hope is that the professionals use these techniques for the patients' treatment. We also hope that researchers use them as a starting point for research and development of novel treatment techniques. We believe that the combination of these methods can lead to the highest and fastest improvement in cognitive performance of a patient.

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