

New Perspectives on Cognitive Rehabilitation, Behavioral and Stimulation Therapies Post Covid-19

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Abstract

Cognitive rehabilitation, behavioral and stimulation therapies appear to have become the de facto standard for the treatment of brain injuries and mental health issues post-Covid. This research proposes what are the most considered appropriate therapy approaches for cognitive therapists. A combination of literature review and face to face interviews was applied to close the identified knowledge gap of what is expected of cognitive therapists and what they can deliver against these expectations. Results suggest that cognitive therapists would benefit from adopting the suggested concepts of neurogenesis and cranioplasty to improve the successful delivery of cognitive therapy. The findings also suggest that some cognitive treatment approaches such as Artificial Intelligence (AI) and Virtual Reality (VR) require further research before their applications in cognitive therapy can be proposed.

Keywords: Cognitive Rehabilitation/Behavioral/Stimulation Therapy; Mental Health; Acquired Brain Injuries (ABI); Memory Disorder; Dementia and 'Rementia'; Long-Covid

Abbreviations

ABI: Acquired Brain Injury; ADL: Activities of Daily Living; AI: Artificial Intelligence; CBT: Cognitive Behavioral Therapy; CDC: Centers for Disease Control and Prevention; CFAT: Constructive Feedback Awareness Training; CNS: Central Nervous System; CO₂: Carbon Dioxide; CR: Cognitive Rehabilitation; CRT: Cognitive Rehabilitation Therapy; CST: Cognitive Stimulation Therapy; GMT: Goal Management Training; IADL: Instrumental Activities of Daily Living; MCI: Mild Cognitive Impairment; O₂: Oxygen; OCD: Obsessive Compulsive Disorder; SMART: Strategic Memory Advance Reasoning; TBI: Traumatic Brain Injury; VR: Virtual Reality

Introduction

The concept of cognitive rehabilitation therapy (CRT) is not new. It appears to date back to World War 1 (1914-1918) when soldiers and civilians received treatment for war-related traumatic brain injuries (TBI). Improvements in medical services during the 1970s led to CRT becoming more established and recognised as an approach to combat TBI-related and other associated injuries. By the 1980s, the concept of CRT was deeply embedded as a solution to improve the conditions of mental health patients. Together with related developments in the areas of cognitive behavioural therapy (CBT) and cognitive stimulation therapy (CST), Ostergen [40] argues that there is now strong evidence that suggests that CRT has become the de facto standard for sufferers of TBI (a view supported by Cicerone, *et al.* [10-12]).

Table 1 presents some considered definitions of the concepts of CRT, CBT and CST in the context of this research.

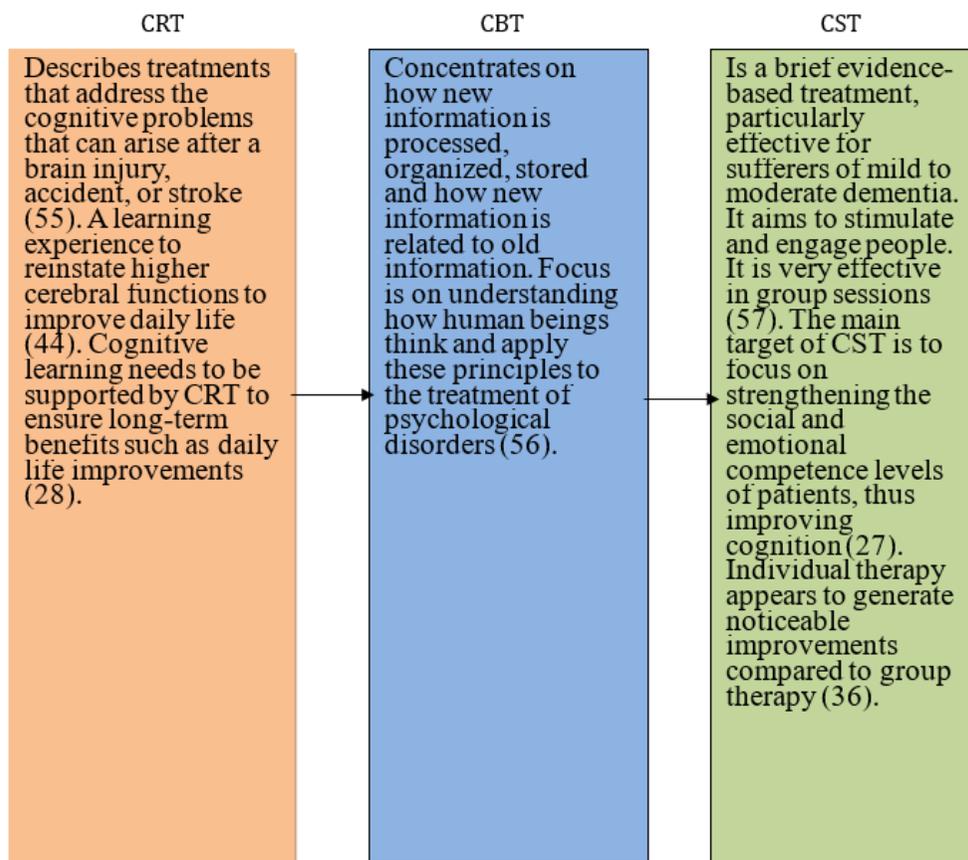


Table 1: Considered definitions of CRT, CBT and CST.

Edward and Khan [16] consider that CRT, CBT, and CST therapy approaches typically include lots of positive affirmation, listening actively to what the patients have to say and avoiding correcting the patients regularly. It appears that supervised community integration, for example, is a key element of cognitive rehabilitation (Section 1.2.3). Ultimately, ‘the goal of rehabilitation after TBI, for example, is to improve the patient’s functioning at home and in society to such an extent that the patient can adapt their disabilities to adopt the required environmental modifications to make the patient’s life as easy and comfortable as possible’ (p. 50). It is vital that the patient’s focus is on ‘schedule and routine’. This makes their lives easier to understand and control. This approach can then be eased later but not at the start of the therapy.

Cognitive rehabilitation therapists ensure that patients’ special rehabilitation needs are met. For example, some symptoms of brain injury border on depression (low energy and lack of concentration) and need to be treated appropriately by a therapist who is qualified to treat depression in patients. Active goals need to be developed to improve the patient’s active functioning. Even the smallest of improvements must be celebrated as a big victory.

Therapists support patients by enabling them to participate in everyday life, by improving their abilities or by modifying their environment so patients can participate better. Activities of daily life include self-care, instrumental tasks (interacting with the environment and

complex tasks) such as using public transport or withdrawing cash from an ATM machine). Patients can thus re-learn movements they had lost due to their injuries, through the appropriate application of exercise and activities. 'The human brain remains a mysterious and complex organ' (p. 90). It is still not possible to predict how each brain heals after injury or what exactly happens during recovery from TBI.

The researchers have adopted the following definitions for this research:

- Traumatic brain injury (TBI) for this research: 'A disruption in the normal function of the brain that can be caused by a bump, blow, or jolt to the head or a penetrating head injury' [9].
- Cognitive rehabilitation (CR): 'Cognitive rehabilitation is a systematic, functionally oriented service of therapeutic cognitive activities, based on an assessment and understanding of the person's brain-behavior deficits. Services are directed to achieve functional changes by (1) reinforcing, strengthening, or re-establishing previously learned patterns of cognitive activity or compensatory mechanisms for impaired neurological systems' [21].

According to the *British Medical Journal* [6], there is a potential link between long-Covid and cognitive problems, and it appears that some common lasting effects of Covid are highly persistent. Some cognitive rehabilitation program patients did not suffer, for example, from traumatic brain injury (TBI). It appears that more doctors are referring patients who suffer from symptoms such as short-term memory problems, slow processing speeds or poor word recall to cognitive rehabilitation therapists.

Literature Review

Mental health issues/dementia

According to Drs van Tulleken [3], mental health issues include anxiety, stress, feeling out of control, depression, obsessive compulsory disorder (OCD) and eating disorder (Table 2). One size does not fit all. Human beings experience these in different and often unique ways. An important part of mental health problems is to talk about it as early as possible and to get help and advice from others or qualified people such as cognitive therapists. Table 2 presents a summary of the main mental health issues and their potential solutions, usually administered by qualified and experienced cognitive therapists. For example, adrenal glands release adrenaline which can increase the heart's beating rate. This is fine occasionally but not when it happens regularly, leading to something known as chronic stress. This affects the health of a person in a big way. Blood pressure is increased, putting a strain on the heart. It suppresses people's immune system. It changes people's metabolism which results in 'weight gain'. Other effects are heart burn, and of course, mental health conditions such as depression and anxiety. These can also lead to so-called panic attacks. Typical symptoms are heart pounding, chest feeling tight and hands sweating. Potential solutions include to move away somewhere else or to seek help from another person. Another remedy includes to sit down and drink a glass of water or tea and start to breathe more slowly. A good balance between CO₂ and O₂ is needed. Too much oxygen makes people feel dizzy. OCD symptoms include not being able to touch, for example, a door handle or touching the carpet in a room.

Mental illness is an ongoing process through life, it is not a one-off treatment cure. For sufferers, it is a new daily 'living' experience 'how to cope with the condition'. It appears that the brain of individual people tells the person that they are the only person who is suffering from this, and not to say anything or talk to another person. It is possible to reduce stress through the application of yoga. This approach relaxes people so that they feel less stress. It releases body tensions and helps to regulate emotions and feelings. Another approach is singing. Saliva samples taken before and after singing confirmed that cortisol levels were reduced substantially (tests were conducted by Westminster University in London). The results of their analysis show that cortisol levels drop by 46% when singing (for yoga, for example, the drop in cortisol level is 33%). Both results show that people's life-time choices have a positive effect on their mental health.

Smyth. *et al.* [48] consider that cortisol levels change during the day. People’s body clock and early morning light provide a ‘search’ to prepare people for the day ahead. Stress affects cortisol levels, and this is bad for people’s health. Negative thoughts can activate the cortisol response, and this has a cascading effect on the body. Exercise and fun activities can de-stress people. Another approach is mindfulness, a simple kind of meditation. For example, people pay their full attention on the breath as it flows in and out of the body, focusing 100% on the present moment. The result is that people are more relaxed and experience changes in their behaviour in a positive way.

Eating disorders (anorexia nervosa) are based on a ‘fear of food’ (in contrast to other disorders such as arachnophobia (fear of spiders). It appears that other things in life get out of control but what ‘stays in control’ is what people eat and when they eat it. Usually, sufferers do not want to seek any attention. Once people ‘open up’, for example, through letter-writing or song writing, it becomes easier to talk to other people about it. It is vital for sufferers to try and ‘let other people in’ to help them when self-help is no longer possible.

Another area of mental health is known as social exclusion, particularly among young people (being left out, not being invited to a party). Social exclusion appears to be treated by the human brain in the same way as physical pain.

According to Foulkes [17], social exclusion is about not ‘feeling belonging’, for example, to a group. This can lead to physical pain. The area of the brain that deals with physical and social pain is the same. Being rejected by a group can lead to mental health problems in people.

It is suggested that counselling helps people with mental disorders such as anxiety and depression. Taking up activities such as photography can help reduce or eliminate these disorders. Symptoms of typical mental health disorders include changes in sleeping, eating, behaviour, tone of messages and habits. A very important approach to help sufferers is to listen actively to them, and not to judge but reassure people and encourage them to seek or get help.

Disorder	Description	Solution
Chronic Stress	Regular release of adrenaline. Hear burn, depression, anxiety, and weight gain.	Sit down, slower breathing, move away from problem. Seek help.
Obsessive Compulsory Disorder (OCD)	Mental illness, not being able, for example, to touch door handles or a carpet.	Talk to others, seek help, not accepting that they are the only person suffering from this.
Stress (general)	Body tensions, high levels of emotions and feelings, high cortisol levels	Yoga and singing. Reduce negative thinking. Conduct fun activities.
Poor Diet	Eating the wrong food (such as pizza, chocolate, sweets, biscuits...low energy levels, grumpy	Eat healthy food such as fruit and vegetables, nuts, oily fish, and drink lots of water; as a result, concentration, energy, and activity levels will go up.
Social Exclusion	Being left out, not being invited. Being rejected by others. Social exclusion leads to stress.	Counselling. Take up activities such as photography. Share feelings with others. Help sufferers by actively listening to them.

Table 2: Typical mental health issues and potential solutions [3].

Williams and Nusbaum [54] argue that it is important for people to be able to consider the perspectives of others as this appears to lead to what is known as ‘wise reasoning’. The reason for this is that it appears that this approach has the potential to help improve the mental health condition of people. Being able to show others empathy, compassion and prosocial behaviour has a direct impact on the mental states of others in terms of understanding their emotions, motivations, and frames of mind, in comparison with one’s own mind [43]. It appears that this will have increased social-connectedness and increased compassion and empathy levels towards others. In turn,

this has the potential to inspire/motivate mental health sufferers to push away negative emotions and feelings and start to see things more from a wider perspective to cope with situations more appropriately. Williams and Nusbaum suggest that the development of, for example, prosocial attitudes and behaviours, social decision-making and pragmatic knowledge of life stem from parts of the brain such as prefrontal and temporal cortices and their impact on other parts of the brain such as the amygdala and the ventral striatum (associated with fear, reward and punishment).

Cognitive decline

Pool [42] reports that the approach how to deal with and manage the conditions of dementia sufferers has changed dramatically compared to, for example, many years ago. It appears that people were treated like objects rather than human beings. ‘There was no sense of dignity or of humanity’ (page 8). In the early 1990s, Kitwood [31] suggested that the priority should be placed on people and not the condition itself. It was Kitwood [32] who pioneered the notion that the focus should be on people’s individual cognitive function abilities and then push sufferers for higher levels of functional abilities. Kitwood and Bredin [33] developed a model for a holistic and person-centred approach to understand the unique experiences and conditions of individuals (Table 3).

Personality	The type will affect how a person deals with a situation and events. This impacts loss and change and will add to/reduce symptoms of dementia.
Biography	This shapes personality and how people learned to respond to situations. Affects current behaviour and responses.
Health	Physical and mental health affects how people behave. Behavior can be mistaken for signs of ill health.
Neurological Impairment	Cognitive limitations related to damage to nerve cells in the brain.
Social Psychology	Attitude and Interactions with others affect the emotional state of a person. Could produce social interaction opportunities.

Table 3: Unique experiences of individuals with dementia [42].

Pool quotes Bredesen [7], Perlmutter [41] and Harcombe *et al.* [20] who argue that cognitive decline is reversible. This can be achieved by applying a person-specific rehabilitation program that is based on improving people’s metabolism to address or reverse neurological conditions. Genetic, lifestyle and environmental factors appear to be the probable causes of brain cell deterioration. Table 4 presents a list of potential impairments of brain functions in relation to nutrition/hydration, another factor that Pool considers have the potential to reduce the symptoms of dementia. These appear to be an association between dementia and weight loss. People who do not eat well and sufficiently are considered to carry higher risk of developing the symptoms of dementia. This includes the regular consumption of fluids and fruits/vegetables with high levels of water. ‘...being dehydrated can decrease your brain function, causing an acute ‘confusional state’ (sometimes called a delirium)’ (page 50). Pool considers that cognitive rehabilitation per se is made up of three elements: nutrition (food affects the human brain), emotion (feelings affect the brain) and cognition (actions that affect the brain).

Genetics	Genetic testing can provide evidence whether certain conditions/symptoms have been inherited. There is no conclusive evidence that this will lead to a development of the disease.
Environmental Lifestyle	It appears that dementia is caused by a combination of environmental, lifestyle and genetic disposition factors. The main lifestyle factors are: <ul style="list-style-type: none"> • Environmental toxins • Gluten • Cholesterol • Oxidative stress • High blood sugars Other considerations include malnutrition, undernutrition, and hydration.

Table 4: Brain cell deterioration factors [42].

Pool quotes Ledoux [35] who reports that the human brain is used as an instrument to understand and treat fear and anxiety. It appears that people who develop an anxiety, show signs of disrupted cognitive and behavioral control when experiencing threats. Holmes [22] considers that prolonged stress has the potential to lead to changes in the human body’s immune system. Holmes conducted some research that shows that stress appears to affect progression in mild cognitive impairment (MCI). High levels of stress appear to lead to brain shrinkage. This view is supported by Kim *et al.* [30] who argue that the stress hormone, cortisol, does lead to a reduction in brain cells in the part of the brain known as hippocampus (long-term memory). In addition, Carroll [8] claims that there is strong evidence that prolonged or regular recurring stress causes premature brain ageing. Pool [42] suggests that an understanding of the common types of memory functions (Table 5) help any considered rehabilitation approach to reduce the symptoms of dementia.

Memory Function	Details
Short-term	Temporary ability to hold information.
Long-term	Permanent long-term memories.
Working	To hold in mind and mentally manipulate information.
Episodic	Keeping the memory vivid and accessible to the person.
Semantic	Refers to general world knowledge (facts, ideas, meaning and concepts).
Procedural	The ways of doing an activity (driving, getting dressed).
Prospective	What needs to be done in the future (appointments, turning off the gas cooker).

Table 5: Common types of memory function [42].

Baba [2] suggests that the use of puzzles such as mazes can improve both memory and cognitive functions within individuals. It appears that puzzles are one of many activities that can help people to recover from traumatic brain injuries (ABI), for example, following an accident or a stroke. According to Baba, positive feedback exists from patients who have applied the use of mazes as part of their cognitive rehabilitation therapies. As a direct observed result, improved memory was the outcome. Baba uses reinforcing positive images in her workbook to maintain high levels of optimism in the user. In addition, a high level of coping is required by individuals. This is necessary so that people can adjust to doing things that may fall outside their comfort zone. People who suffer from, for example, physical injuries, may need to make good use of tools that will help them to recover, such as the use of a walking stick to aid movement. In the case of cognitive injuries, this could mean the use of visual images to encourage increased memory activity. Baba argues that keeping an activity diary and results will aid the recovery process. People with brain injuries wish to improve, for example, their memory and concentration whilst at the same time managing associated side-effects such as anger and frustration. Recovering from a brain injury can be a very slow and incremental process. The completion of maze exercises can help people to understand their cognitive abilities. This will aid with the integration of the optimum approaches to achieve mental recovery.

Traumatic brain injury, brain damage, anxiety and cognitive rehabilitation approaches

Ostergen [40] considers that people who suffer from traumatic brain injury (TBI), benefit not just from a speech-language pathology. There appear to be many facets of rehabilitation, for example, after a stroke or car accident. These include cognitive rehabilitation therapy (CRT), based on the increasingly important role that cognition plays in communication (including augmentative and alternative communication), daily activities people engage in and the associated rehabilitation process after TBI. No two individual people who suffer from TBI or who require CRT, are the same, due to the uniqueness of the sustained injuries. It is for this reason that the application of rehabilitation techniques and the rehabilitation approach per se can never be the same and need to be holistic. This kind of application would generate the greatest number of potential rehabilitation options to meet the needs of all individuals. It is for these reasons that it is imperative to consider not only any trends as far as TBI is concerned but also consider TBI’s neurologic impact on those affected by TBI (Table 6).

Clinical Signs	TBI Characteristics
Loss of or decreased consciousness.	Changes in consciousness level.
Loss of memory immediately before or after an injury.	Memory disturbances.
Neurologic deficits such as muscle weakness, loss of balance or disruption of vision/speech.	Deficits in orientation.
Mental state alteration such as confusion, disorientation, and concentration.	Neurological signs including but not limited to visual field deficits, partial one-sided paralysis (hemiparesis) and worsening of seizure disorder.

Table 6: Traumatic brain injury (TBI) characteristics and clinical signs of disruption [40].

Ostergen [40] reports that the human brain has an inherent ability to change (known as plasticity). The associated nervous system’s ability to change, too, is generally referred to as neuroplasticity. This involves specific changes in response to environmental cues, behavior or injury [31]. Specifically, changes can occur in the cognitive, sensory and motor systems of the central nervous system (CNS, according to Moucha and Kilgard, [37]).

According to Benedict, *et al.* (4, cited by 24), CRT methods include the use of modeling, guided practice and distributed practice, errorless learning, direct instruction with feedback, paper and pencil tasks, communication skills, computer-assisted retraining programs and the use of memory aids. CRT sessions are typically individual or small group based (4, as cited by 24).

In contrast, according to the Institute of Medicine [24], cognitive behavioral therapy (CBT) applies different techniques and has different goals. For example, CBT is applied with people who suffer from emotional and psychiatric disorders. This approach helps individuals who hold maladaptive thoughts and emotions. The CBT approach focuses on, for example, training in anxiety management, and in some instances being exposed to anxiety provoking or distressing stimuli so that appropriate adaptive emotional responses can be established. The IOM suggests that there are two concepts of cognitive rehabilitation therapy (CRT): modular and comprehensive. Modular CRT is primarily applied for use to treat patients with a singular or predominantly cognitive impairment. Comprehensive CRT focuses mainly on multiple cognitive impairments/domains within patients and in areas such as more than one cognitive domain or deficits in self-awareness. There appear to be different categories associated with cognitive rehabilitation [24]:

- Restoration aims to improve, strengthen, or normalize an adversely affected cognitive function. Applied are repetitive, drill or exercise-like activities that target specific cognitive processes. The approach is to gradually increase the difficulty and demand levels.
- Compensation approaches appear to provide alternative strategies for completing the usual every-day tasks of people such as alarms, note-books, mnemonics and ‘usualizing’. As solutions rely on both internal and external items important to the individuals, it is a necessary requirement to tailor any compensation or specific strategy to the needs of the individuals.
- A calibration approach refines awareness and self-measurements of the cognitive performance within individuals. This practical application helps to shape the behavior of people, for example, after a traumatic brain injury (TBI). It includes how effectively individuals conceptualize and evaluate given tasks.

According to Johnson and de Haan [26], the human brain and its associated mind, are made up of hierarchical and parallel systems. Any brain damage that is caused, for example, by an accident or a stroke, it appears, is not able to dissociate the different hierarchical

organization levels. Applying a developmental cognitive approach makes it potentially possible to observe any hierarchical control. It creates ‘particular opportunities’ to study how neurocognitive systems develop and how these are integrated during the development stage. Infants have a reduced version of an adult mind developed through step by step increases in the areas of human brain pathways and structures. An alternative view considers that there are no intrinsic and extrinsic structures that hold a dynamic relationship. Johnson and de Haan [26] quote [18] who labels these as predetermined epigenetic (sequential steps). Of the two considered approaches (predetermined epigenesis and probabilistic epigenesis, Table 7), the predetermined epigenetic view is concerned with the notion that the mind of an infant can be compared to that of an adult with frontal lobe deficits. Understanding the functioning of these cognitive mechanisms can help cognitive therapists to develop optimum approaches to improve mental disorders of adults.

Johns [25] reports that cognitive rehabilitation therapy (CRT) plays an important role in the ‘instrumental activities of daily living’ (IADL). These activities allow people to live independently within a given community. Although IADL is not necessary for so-called functional living, being able to apply IADLs can make a significant difference to people’s daily lives. In addition, according to Kernisan [29], there are ‘activities of daily living’ (ADL, Table 7). These appear to be the key tasks that people need to perform to live at home and remain independent. Johns suggests that this includes (but is not limited to) the following activities:

- To achieve independent living
- Development of assistive technologies for IADL completion
- Smart prompting technologies
- Remediation of specific cognitive functions
- Neuro-psychological principles
- Retraining methods
- Maximum level of vocational and independent-living abilities.

Activities of Daily Living (ADL)	Instrumental Activities of Daily Living (IADL)
Walking-getting round the home and outside	Managing finances-paying bills and managing financial assets
Feeding-getting food from the plate into the mouth	Managing transportation-driving or other means of transport
Dressing and Grooming-selecting and putting on clothes	Shopping and meal preparation-includes everything to prepare a meal plus clothing
Toileting-getting to and using the toilet appropriately	Housecleaning and home maintenance-keeping the house clean and well maintained
Bathing-washing the face and body in a bath	Managing communication-telephone and mail
Transferring-moving the body to new positions such as ‘bed to chair’ and grasping assistive devices	Managing medications-observing medication and taking these at the right time

Table 7: List of ADLs and IADLs.

In this context, it is worth noting that the number of head injuries, for example, in the UK, is rising. Johns suggests that ‘basal ganglia loops passing through the caudate nucleus arrive and terminate in the prefrontal cortex’ (p. 42). It appears that these influence cognition and behavior and contribute to the control of visual attention/glaze. Incremental activities in the caudate-prefrontal connections leads to a rise in obsessive compulsive disorder (OCD). According to Johns, dementia symptoms include sufficient declines in memory, intellect, or personality. These appear to interfere with people’s daily lives including work. Table 9 presents a list of common clinical features of dementia. This list is not exhaustive, and the potential areas for degenerative improvement will be different form person to person. Equally affected are the distribution and the severity of the changes.

Shafran *et al.* [47] purport that it is difficult for people to change, for example, if they suffer from anxiety. It appears that showing empathy towards how people who suffer from anxiety, feel and deal with anxiety, is important to help, encourage and support sufferers for them to make the necessary changes to overcome and manage their anxieties. It is of equal importance for this to work effectively. The person affected by anxiety needs to be committed, too, to make changes to improve their mental well-being. Selling the benefits to others (why they should change), appears to be of paramount importance to success. Shafran *et al.* [47] suggest that there are many different types of disorders (Table 8).

Disorder	Features	Symptoms
Specific Phobia	Frightened of one specific object.	<ul style="list-style-type: none"> • Avoidance: running away from or avoiding situations of potential anxiety. • Intensive thought/images/memories: thoughts about problems /symptoms leading to anxiety experience. • Bodily arousal: heart racing, difficulty breathing, sweating, butterflies in the stomach. • Over-vigilance to danger/threat: constantly on look-out for things that may be personally harmful. • Overestimation of danger/threat: level of threat to danger out of proportion, constantly looking for danger, world becomes a dangerous place. • Compensatory safety-seeking behavior: short-term steps to feel better, worst feeling long-term. • Low mood: worn-out and feeling defeated by the anxiety. • Worrying: too much ‘What if ‘thinking, leading to anxious thinking.
Panic Disorder	Frequent periods of intense fear and anxiety without any real danger.	
Generalized Anxiety Disorder	People feel anxious most of the time/prolonged periods about many things.	
Social Phobia	Excessive anxiety due to presence of others appearing to judge sufferers.	
Health Anxiety	Hypochondriasis-fear of having a serious disease.	
Obsessive Compulsive Disorder (OCD)	Having thoughts, impulses and images that make people anxious (obsession), and then carrying out actions/behaviors to prevent harm (the compulsion).	
Posttraumatic Stress Disorder (PTSD)	Flashbacks of events leading to anxiety from events such as war or disaster.	

Table 8: Specific and common symptoms of anxiety disorders [9].

As with other issues or problems, it is important to understand what the actual problems are. This includes looking at so-called maintenance factors-the vicious cycles that keep anxiety going. In addition, personal goals should be set (SMART=specific, measurable, achievable, realistic, and time-bound). The next stage of therapy is concerned with considering strategies that will enable the sufferer to implement planned changes. This is followed by the final stage that is primarily concerned with continuing with implemented changes even after the therapy has ended. It includes the m of problems returning. Shafran., *et al.* argue that a therapy structure should be set up

as being 'semi-structured'. It will thus be possible to address something that is considered important, irrespective of the original plan. A cognitive behavior therapy (CBT) approach needs to be flexible as no two people are the same, and therefore, no two CBT sessions can be the same. CBT techniques are sometimes referred to as a 'toolkit'. This 'toolkit' teaches sufferers how to think about their problems and how to cope with these problems. Should people's anxieties become worse again, they are in a good position to identify when this happens and then use the 'toolkit' to stop any anxiety from becoming a big problem again as was experienced before. According to Shafran., *et al.* [47], anxiety disorders originate from people's beliefs that they are in a threatening situation that is dangerous and threatening to them. The interpretation of the situation is a personal evaluation. This is driven by the evaluation of any situation by individuals in terms of the meaning of the situation to them. It appears that it is not any event that causes people to feel anxious, for example, but their interpretation of that event. Shafran *et al.* [47] further report that when people become anxious, the way they process information does change. People who feel anxious, see everything through anxious 'lenses' without realizing it. The reason for this is that seeing things in an anxiety-related and threatening way will make the person even more anxious. 'Thoughts, feelings, physical symptoms and behavior are closely linked to each other: making changes to one of these will bring about change in the others, too' (p. 43).

Ressel *et al.* [45] report that acquired brain injury (such as TBI) can lead to a wide range of cognitive dysfunctions. This includes areas such as memory, learning, perception, and problem solving [5]. Depending on the extent of the brain injury, different parts of the human brain's network may be disrupted. This has a direct impact on any potential cognitive recovery as outcomes are affected by the therapies performed. In addition, people's developmental stage (adult, child) affects the course of recovery. Therefore, it is necessary to optimize individual therapies by making the best use of cerebral plasticity and recovery mechanisms [39,51]. Ressel *et al.* [45] tested markers from conventional and diffusion magnetic resonance imaging (MRI) to assess whether these could act as potential predictors of cognitive outcomes, following rehabilitation therapy in children who suffered from ABI. They conclude that conventional MRI injury scores may provide important markers for cognitive recovery following an ABI. The researchers will discuss the need for more longitudinal studies to provide further supportive evidence in the Discussion section.

Alternative cognitive treatment approaches

Tate *et al.* propose the following three additional cognitive treatment approaches. These are not in any order of priority: goal management training (GMT), strategic memory advance reasoning (SMART) and constructive feedback awareness training (CFAT). Goal management training is based on theories of sustained attention [49,50]. The primary focus is on laps of sustained attention that potentially impair higher order goals, leading to distracted behaviors (for example, the need to memorize a new permanent route to drive to work, replacing the old habit with a new one).

Strategic memory advanced reasoning (SMART) is recommended for use in post-acute stays of TBI. It benefits individuals who suffer from not being able to complete tasks that involves flexible and innovative thinking and problem-solving. It is equally applicable for people who hold sufficient mental processing capacities to complete SMART tasks [53].

Gist reasoning [40] helps people who are finding it difficult to complete complex tasks when some creative way of thinking is involved. This approach is also suitable for individuals who have enough information processing capacity to complete SMART tasks. Gist reasoning is an important skill to have in communication and normal daily activities. This includes face to face conversations, listening to the radio or reading for employment/pleasure. The final considered cognitive treatment approach is recommended for people who show evidence of impaired self-awareness following, for example, a TBI. In addition, it will help people who have adequate functions in the areas of cognitive, sensory, and motor; to engage in theory and assessment tasks. Ostergen suggests applying CFAT by using the following steps: pre-tasks analysis, task feedback and post-task reflection. This is a necessary requirement to address all aspects of awareness (anticipatory, error recognition and self-regulation). It appears that group-based applications of so-called social communication training (SCT) is most effective in actual group sessions rather than based on training individuals. This is most effective for people who have: difficulties with

social communications in real-life environments, a regular communications partner and sufficient memory/cognition/speech/language abilities to interact with group level contexts.

Eagleman [15] explains that the human brain has a remarkable capability. It can re-wire itself to react to and act upon inputs/outputs and tasks. Unlike a computer, for example, the human brain can re-configure itself using its own circuitry. It appears that a child's brain is far more flexible than an adult's brain. It is, in this respect, quite flexible. Having said that, the flexibility of an adult human brain is not quite as flexible as a child's but can nevertheless still produce some remarkable abilities to adopt and change. When exposed to something new, the human brain changes itself to accommodate the new. It is this plasticity that makes it possible to bring together new technology and the human biology.

It appears that the human brain does not care how it gets information. Important is that it receives it. Eagleman [15] suggests that 'As we move into the future, we will increasingly design our own sensory portals on the world. We will wire ourselves into an expanded sensory reality' to investigate, for example, how the application of cranioplasty impacted on patients with post-traumatic brain injuries (TBI).

The results suggest that there are synergetic effects, created by applying cranioplasty, in areas such as rehabilitation training and cognitive recovery. It appears that, under normal circumstances, neurological hindrance interferes with any progress made, for example, in post-TBI rehabilitation. This often leads to causing inconveniences in people's daily lives [13,14]. It appears that how people function daily (including cognitive functioning) is improved through the application of cranioplasty intervention during periods of rehabilitation. The outcomes from this research suggest that cranioplasty should be considered when designing rehabilitation treatment plans for patients with TBI.

According to Gupta [19], the human brain can be changed constructively, enhanced, and fine-tuned, for example, by encouraging the generation of new brain cells (known as neurogenesis). This has the potential to increase the brain's size. Keeping the human brain in good shape (good hydration, healthy food, and regular exercise) is of paramount importance. It leads to improved decision making, improved resiliency levels, a more positive attitude, and physical improvements. A resilient brain appears to be able to withstand ongoing trauma more readily. Optimizing the human brain can lead to increased resiliency, and this in turn will enable the brain to cope better following, for example, a brain injury or stroke. One core ingredient of resilience is the human brain's plasticity (the builds of new dendrites or 'projections' that convey information to the cell body). And it is the brain's plasticity that can help the brain 'to rewire itself', for example, after an accident or trauma experience. Focusing on increasing the brain's plasticity can help, for example, cognitive therapists to improve cognitive impairment in their patients, following injury or a stroke. Gupta [19] suggests that the human brain constantly shapes and reshapes itself, 'in response to experiences, learning or even an injury' (p. 87). As such, exercise, for example, can help to fix 'damaged brain cells, speeding up recovery after injury, stroke or a significant emotional stress' (p. 107). It is possible to build a so-called 'cognitive reserve', with the help of cognitive therapists, by placing demands on the brain to engage in activities such as thinking, strategizing, learning, and solving problems.

Knowledge gap

The outcome from this literature review revealed that there is a need to investigate further the practical applications of CRT, CBT, and CST. It appears that there is a widening gap between what is expected of cognitive therapists and what they can deliver against these expectations. This current research is about the nature of this shortfall and how this gap could be filled. The results from the literature review, on their own, have been valuable but inconclusive. The practical insights and knowledge and experience from the community of cognitive therapists will help to close this gap.

Main Research Questions

The main research questions for this research are:

1. Is it possible to reverse the symptoms of dementia (rementia) through the application of CRT/CBT/CST?
2. Can the applications of CRT/CBT/CST achieve higher levels of mind convalescence in mental health patients?
3. Can CRT/CBT/CST aid the reinstatement of lost mental functions such as thought, memory and reason?

Research Methodology

Method

The researchers applied a critical text interpretation approach (a priori) together with the collection and interpretation of primary research data from the face-to-face interviews with cognitive therapists (a posteriori). As such, the researchers considered that a so-called constructivist interpretivist research approach was most appropriate for this research. The target was to ascertain what was already known about the topic under investigation (literature review) and to obtain the current thoughts and opinions of practicing cognitive therapists (practice). Table 9 is a short summary of the main research questions asked during the face-to-face interviews with cognitive therapists from Headway, Swindon, United Kingdom, a charitable organization that looks after patients who suffer from brain injuries following an accident or a stroke. The center provides a comfortable and familiar environment for those who suffer from brain injuries. Applying cognitive rehabilitation therapy (CRT) improves the real-life situations of patients in typical areas such as self-esteem and self-confidence. The limited number of interviewees have over 40 years of practical CRT experience between them and hold recognized certificates in CRT.

Questions asked during the interviews

1. How does CRT/CBT/CST contribute to develop ‘rementia’ in mental health sufferers?
2. Is there a relationship between ‘rementia’ and applied CRT/CBT/CST?
3. How can CRT/CBT/CST contribute to develop mind convalescence in mental health sufferers?
4. Is there a relationship between mind convalescence and applied CRT/CBT/CST?
5. What are the contributions of CRT/CBT/CST to achieve higher levels of mind convalescence?
6. What is the value of convalescence for sufferers of mental disorders? What do we know about CST specifically?

Table 9: Face to face interview questions for research participants.

Data collection and interpretation

The researchers considered that two approaches were most appropriate for the collection of relevant research data, to answer the main research questions (1.4): a literature review, (1.2) and face-to-face interviews (3.1). The contributions from each of these approaches enabled the answering of the main research questions. The findings from these approaches concentrated on evidential analysis and interpretation of the collected research data. This was strengthened by the contemporary views from the interviewees, thus enabling the presentation of a balanced overview. All interviews were conducted consistently and coherently. The researchers’ primary focus was on the generation of sufficient supportive evidential data. This improved the reliability and validity of the research data.

Results

Face to face interviews with cognitive rehabilitation therapists in the United Kingdom

How does CRT/CBT/CST contribute to develop 'rementia' in mental health sufferers?

'First of all, dementia describes a group of symptoms that include the sudden or gradual diminishing of behavioral abilities and cognitive functions such as thought, memory and reason. Dementia hinders people to perform daily basic activities. There are different stages, ranging from mild (staying independent) to severe (needing full-time care and help). The areas most affected include motivation, emotions, and language. As dementia progresses, different symptoms present themselves in different levels of severity. All depends on the type of dementia someone suffers from. When neurons/brain cells cease to function, connections are lost to other brain cells, and these 'die'. People with dementia experience a higher level of loss when brain cells stop to work. CRT/CBT/CST provide 'pathways' or means of retraining the human brain, by doing things in a different way, for example, by using repetitive information or by repeating certain activities. This creates a kind of structure and routine. A good example is 'to keep keys in a certain location' so the patient can learn this new routine and feel more comfortable and reassured. This approach helps to organize rehabilitation.

What is the value of convalescence following brain injuries? What do we know about CST specifically?

'Stimulation is vital to rehabilitation. For example, writing down instructions 'what to do do' or 'where to find things' in one's own handwriting, further enhances the chances of coping better with the symptoms of dementia, for example, as sufferers will recognize their own hand-writing and therefore 'trust' the instructions or directions more easily. This is a very important aspect of the therapy. Dementia patients often become 'child-like' and can get upset very quickly if their perceptions are argued against (for example, they think that the day of the week is Wednesday when, in fact, it is a Friday). It is a kind of return to human beings' early baby-stage in life. The result is a high level of frustration that patients often express by being aggressive. It appears that this is more often seen in cases of dementia rather than brain injury. We have experienced this in patients that have severe memory issues (following a brain injury) who do not mind being corrected, whereas dementia patients do mind being corrected.

Rehabilitation, behavior, and stimulation therapies can start new pathways. Using language to overcome speech issues, people who find it difficult to talk and express themselves, gain higher levels of confidence by 'singing' what it is they wish to say, using a different part of their brain (relevant to brain injury patients). This is a good example how rehabilitation therapy can 'get round things' to help improve current shortfalls in patients. If one path does not work for the patient, then therapists will look for suitable alternatives to fix the issue.

A greater level of brain injury (BI) awareness is necessary to educate people more about 'what it means to be affected by this' and what the associated behaviors are, for example, of people who experienced a stroke or car accident. People often carry a 'stigma' as people jump to conclusions as far as behavior is concerned (for example, someone acting strange or 'talking funny' must be a drug addict or alcoholic). A better understanding of the concept of brain injury would undoubtedly make such a positive difference to support those with brain injuries more productively' (Sonia).

Is there a relationship between 'rementia' and applied CRT/CBT/CST?

'Yes, there appears to be a relationship between 'rementia' and the therapy received following, for example, an accident. It usually takes up to two years for so-called acquired brain injuries patients (ABI) to recover from their traumatic experience. Brain injury professional appear to claim that this is how long it usually takes. We have experienced progress being made for a much longer period due to ongoing rehabilitation. Depending on the severity of the brain injury, some patients will never recover fully and retain some ongoing issues. Usu-

ally, patients come to terms with their new 'life', and this often leads to an increase in their ability to look 'elsewhere' for improvements, considering other options they have probably not considered before.

Progress is experienced by clients through cognitive stimulation and by maintaining their current mental state through exercises such as solving puzzles to stimulate the brain. Not every ABI condition will show signs of improvement and the recovery process will take time. In this respect, the brain is just like a 'muscle': regular exercise will improve mental health over time. We see the importance of ongoing rehabilitation as a form of 'practice of skills' to keep patients' abilities at a maintenance level. It is vital for us to 'keep going' to keep our ability to complete our work successfully. Any delay could adversely affect the therapy work we are doing.

Different activities can have a major impact on the 'health' of the brain. The variety of activities include social interaction to improve thinking and developing self-confidence levels. Important is the quality of the therapeutic engagement. The therapy needs to adopt and adapt the right behaviors to move forward. This is vital, for example, where patients have adopted certain undesirable behavior traits that have produced negative impacts in the past. If not treated in the right way, these can become degenerative. Therapists also need to understand that some patients have adopted symptoms that other patients suffer from (by sharing their experiences with each other). Seizures could be the result of this side-effect of brain injuries' (Jane, Sonia).

What do we know about CST specifically?

'Some stimulation is conducted through so-called electro-therapy. This is used when functional stimulation is required. This is known as functional electrical stimulation-often a current is applied to a muscle through an electrode that is attached to the muscle externally. The patient can apply this to 'wake up the muscle' and to encourage it to support the body in a task. As far as the human brain is concerned, CST can be applied to improve signal-deficiencies in the human brain. When neurotransmission in the brain is not working properly, mental illnesses can occur including tremors. Surges in electrical signals inside the brain may cause, for example, recurring seizures and epilepsy. So-called deep brain stimulation switches off the area of the brain that causes any seizure. This approach can also be used in degenerative conditions such as 'Parkinson's disease' (Sonia).

Practitioners suggest that appropriate CRT, CBT, and CST skills, on their own, do not make an effective cognitive therapist. It is the practical application, in the context of each new situation, that drives the effectiveness of these skills. They suggest that the identified approaches and skill sets need to be applied, in appropriate situations. There is no 'one size fits all'. Adopting and adapting skill sets/approaches are of paramount importance for this to work with different patients. The sharing of the practitioners' practical knowledge and experience made a major contribution to establish what the final set of CRT, CBT and CST therapy approaches should be.

Discussion

It appears that the applications of CRT, CBT and CST have the potential to become the de facto standard for treating brain injuries and improving associated mental health issues of sufferers. It is imperative that cognitive therapists accept that patients need to be treated as human beings and not as objects. They need to focus their attention on a person-centered approach that considers people's personality (how a person deals with a situation/event), biography (affects current behavior and responses), health (physical and mental health) and neurological impairment (cognitive limitations relating to damage to nerve cells in the brain). Understanding why and how patients differ, can make a fundamental difference to how successful cognitive therapy can be applied. No two people are the same. Any planned and applied cognitive therapy needs to reflect this. It is of paramount importance that cognitive therapists develop and design appropriate 'toolkits' in readiness to align this with any traumatic brain injury (TBI). It appears that cognitive decline, for example, can be reversed. Cognitive abilities can be improved by understanding the common types of memory functions. In addition, so-called 'maze exercises' can

be applied to further improve associated cognitive abilities (brain fitness exercises). An improved understanding of the human brain's inherent plasticity is vitally important to cognitive therapy, too. The human brain can respond well to specific changes in response to 'environmental cues', behavior, or injury'. Cognitive therapists can put this knowledge to effective use for the benefit of TBI sufferers. In contrast, cognitive behavior therapy (CBT) is primarily aimed at people who suffer from emotional and psychiatric disorders. Therapists need to focus their attention, for example, on anxiety management, to establish appropriate adaptive emotional responses in patients.

Conclusion

Considering all the challenges cognitive therapists are facing post-Covid, it is evident that one area where cognitive therapists can make a major contribution towards improving the daily lives of people who, for example, suffer from traumatic brain injury, is the application of patient-specific therapy (CRT, CBT, and CST). Cognitive therapists need to further focus their attention on the concepts of neurogenesis and cranioplasty. Encouraging the generation of new brain cells is paramount to increasing the brain's size, thus helping the brain to 'rewire itself'. Regular cognitive exercises can help to repair damaged brain cells, with the result that patients will recover much faster after an accident or stroke. Cognitive therapists should consider the application of cranioplasty in post-TBI rehabilitation training and treatment plans, to improve the daily lives of their patients. Cognitive treatment options, on their own, do not make an effective cognitive therapist. It is the application of these that is of paramount importance. It is the catalyst to becoming and being an effective post-Covid cognitive therapist. This research was limited to a small group of cognitive rehabilitation therapists within one organization. Future research would benefit from a larger sample group and the inclusion of the concepts of Artificial Intelligence (AI) and Virtual Reality (VR). The research questions from 1.4 have been answered and the knowledge gap identified in 1.3 has been closed.

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