

Recent Trends in Rehabilitation in Traumatic Brain Injury: Review

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Abstract: Traumatic Brain Injury (TBI) is an intracranial injury due to external pressure or force to the brain. It has a diverse spectrum of psychological, behavioural and neurological symptoms depending on the type and severity of the injury. The primary purpose of this review paper was to integrate the recent trends in the rehabilitation of TBI, specifically focussing on the cognitive and vocational therapies used. The paper also combines the new non-traditional methods used in rehabilitation of TBI by conducting a systematic review of the literature. These topics were selected as cognitive and vocational training is vital in TBI due to the prominent deficits in executive functioning; hence, it is important to highlight the recent trends. This research will bring about a comprehensive knowledge base of the latest rehabilitation techniques. The literature was collected through various online databases like EBSCO, JSTOR, Google Scholar, ProQuest, and PubMed.

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I. INTRODUCTION

Traumatic Brain Injury (TBI) has a diverse spectrum of psychological, behavioural and neurological symptoms depending on the severity of the injury. The severity level can be classified into mild/moderate and chronic/severe. It is considered to be mild when the immediate post-injury symptoms like loss of consciousness, presence of confusion, disorientation, and delirium like feeling does not persist for more than thirty minutes. The neuroimaging often indicates normal functioning, however the individual experiences some deficits in executive functioning like attention, thinking, and headache. Memory problems are also a common occurrence. When an individual suffers from a chronic or severe TBI, the post-injury symptoms last longer than thirty minutes which could be accompanied by memory losses that last longer than twenty-four hours. Here, the individual experiences deficits in higher-order cognitive functions and in some cases, the individual could also experience coma states. Impairments also extend to restricted bodily movements, speech, and emotional dysregulation.

The first line of treatment received is upon arrival in most cases — the primary aim to manage brain damage and stabilize the physiological functions. Attention is then drawn towards the rehabilitation of the individual back in the society. Rehabilitation is crucial for patients with TBI. The rehabilitation programs aim at stimulating internal recovery, prevent further complications, regain or compensate for the lost cognitive deficits and help them manage the handicap if any. The ultimate aim to help them reach their optimum level of functioning so that they become independent and competent to re-adjust to society.

Rationale

This review paper aims at bringing together the latest techniques in the rehabilitation of traumatic brain injury as TBI incidence rates have significantly increased in the past. Emphasis is given to cognitive and vocational therapies as these two are the core aspects of the rehabilitation plan for TBI. Further, with the advancement of research on TBI, new techniques have shown significant results. Therefore the paper aims to amalgamate the recent trends to have a ready knowledge base for the same. Therefore, this article aims at arriving at an integrative resource for the topics mentioned above.

II. PROCEDURE AND METHODOLOGY

A systematic search was conducted by the use of keywords like- Traumatic Brain Injury, rehabilitation, cognitive deficits, vocational training. Studies were selected based on their relevance, journal that they were published in and credibility. These studies were procured using various online databases like EBSCO, JSTOR, Google Scholar, ProQuest, and PubMed. This review brings together the latest advancements in cognitive and vocational training in the rehabilitation programs for traumatic brain injury. Hence, studies about these topics were rigorously reviewed to establish a comprehensive knowledge base of techniques that work.

III. DISCUSSION

Cognitive Therapies

Most of the studies on rehabilitation of traumatic brain injury have used cognitive therapy; therefore, one aim of this review paper is to integrate the recent trends in this technique for bringing about a more comprehensive understanding. The cognitive therapies focus on improving the deficits in their cognitive functioning. The various techniques aim to enhance the attention, perception, planning, memory and other cognitive functions in individuals with a traumatic brain injury. The literature available suggests that cognitive rehabilitation therapy models differ in their approach to treatment. For instance, some models target one cognitive function, whereas others could focus on multiple domains at the same time (modular versus multi-modal models).

Similarly, the focus could also be to restore the deficits or to compensate for the lost ones. The cognitive rehabilitation therapy also varies with respect to the level of severity of the brain injury. They also act as good predictors for prognosis and therefore, cognitive techniques for acute and chronic cases of TBI should be explored separately.

Deficits in executive functions are observed in patients with chronic TBI. Studies have suggested that cognitive training helps in improving executive functioning. Various neuroimaging techniques support this theory. A study by Ramanathan and colleagues investigated whether evidence-based cognitive rehabilitation therapy could bring changes in the executive control lateralised in the right hemisphere (executive functioning) and the associated neural networks (prospective memory). The results indicated an improvement in the executive functioning and an increase in the activity levels and neuronal connectivity in the associated brain regions. Functional and structural changes were observed on the neuroimaging results, which confirmed their findings (Ramanathan, Turner & Stevens, 2018).

Mild/moderate TBI has been widely researched due to its prominent prevalence. A study by Guise (2017) suggested that the length of the post-traumatic amnesia is one of the best indicators of the behavioural, executive and memory functions in individuals with mild/moderate TBI. Combining cognitive remediation and psychotherapy has also yielded significant results in cases of mild TBI. Studies have indicated a reduction in emotional distress and improved global emotional functioning, along with an increase in cognitive functioning (Tiersky et al., 2005). Further, some studies on soldiers with mild/moderate TBI have indicated that sleep difficulty is a common presentation. Significant sleep disturbances and decreased sleep quality was observed (Amy J Jak, Candice C ColÃ3n, Sean PA Drummond & Elizabeth W Twamley, 2015).

Another growing line of research in cognitive rehabilitation techniques advocates that the level of severity is not the best predictor of prognosis as there exist a lot of contradictory studies supporting the same. These researches have emphasised on the concept of 'cognitive reserve'. These studies suggest that the prognosis is better in individuals who had a higher level of functioning before the traumatic brain injury. This is because of the presence of a larger cognitive reserve compared to others despite the brain damage. This cognitive reserve comprised of an individual's intelligence quotient (premorbid), their past education and occupation achievement and the amount of stimulation their brain has received cognitively. A recent study in 2017 studies the relationship between TBI and cognitive reserve and used correlation and regression models to suggest a significant relationship between the two except for occupational achievement. The study also suggested that cognitive reserve also plays an essential role in compensatory resources that help in faster recovery (Leary et al., 2017).

Vocational Therapies

The first line of rehabilitation received by individuals with TBI is focused on regaining the cognitive deficits and repairing the structural damage if any. This is supported by helping them build skills of everyday functioning. This is an integral part of their rehabilitation. Through the review, it was found that vocational and occupational therapy is a crucial part of rehabilitation. Therefore, this review paper aims at bringing together the current research trend in this domain.

Assistive technologies are observed to help compensate for cognitive deficits and improve their employment opportunities. A study by Leopold and colleagues (2015) indicated that the use of technological devices in rehabilitation programs facilitated a smooth transition from academics into employment among adolescents with TBI. Another approach in rehabilitating individuals with TBI back in the community is through positive psychology. Research has indicated that fostering positive emotions in them helps in a better prognosis and easier re-adjusting in society. It helps in resilience building and improving social and emotional functioning. The use of positive psychology has seen to have significant improvements in job stability, satisfaction and other occupational and vocational measure (Mills & Kreutzer, 2015).

Neuropsychological information also aids in vocational preparation. This, however, has not been widely researched. Studies reveal that neuropsychological assessments act as good predictors for employment result; therefore, these assessments can be used as an underlying structure upon which the rehabilitation plan can

be generated. The neuropsychologists can provide insights into the core factors that could cause hindrance while going back to work. Hence, it can be concluded that incorporating a neuropsychologist in the rehab plan has potential benefits.

Studies have also highlighted the use of meta-cognitive strategies to promote the overall functioning of individuals with TBI. A study suggested that providing occupational rehabilitation through cognitive orientation yields significant results, thereby having the potential to improve daily functioning (Skidmore et al., 2011).

Non-Traditional Methods

Non-traditional methods in TBI rehabilitation are catching attention. With the advancement of technology and an increase in the understanding of TBI and factors that aid in treatment, researchers have started to explore alternative ways of rehabilitation. A study in (2018) suggested using Wilderness Adventure Therapy in conjunction with traditional cognitive therapy for adolescents with TBI. WAT is a form of contextualised intervention which builds on the concept of experiential learning. This therapy shows maximum benefit with the at-risk population as it targets social integration and behavioural modification. According to the literature, there are only three rehabilitation programs that incorporated WAT, where significant improvements were observed.

Online Family Problem Solving therapy has been used to reduce behavioural morbidity in adolescents. A study by Wade investigated the role Counsellor Assisted problem-Solving, a form of FPST, in bringing long-term improvements in the overall functioning of adolescents with TBI. This technique consolidates various aspects that increase the efficacy of the online therapeutic alliance and have shown to bring behavioural alteration in adolescents. Results indicated that CAPS to be beneficial during the early months after injury ("Online Problem-Solving Therapy After Traumatic Brain Injury: A Randomized Controlled Trial", 2015).

Studies have also suggested the use of extra practice separate from therapy sessions to amplify the effects of the training received by the patients with traumatic brain injury. These findings are significant for patients who have a higher level of intrinsic motivation, an optimal level of executive functioning has been regained, and less severe brain injury (Leung, Fereday, Sticpewich & Hanna, 2018).

Initial evidence regarding the use of Actual Reality to increase everyday global functioning in individuals with TBI has been observed to be useful. A study used a between-subject design to compare the performance on the actual reality task between TBI patients and healthy controls. The results suggested that since the experimental group experienced significantly more challenging to complete the task, AR would assist TBI patients (Goverover & DeLuca, 2015). A study by Dykestene and colleagues (2018) investigated the effect of playing piano on patients with mild traumatic brain injury. They also assessed if this could stimulate the re-routing of neural networks that were damaged due to the injury. A pre-post methodology was used using fMRIs. Functional changes in the brain along with specific behavioural changes were observed post an eight-week trial, thereby suggesting a causal relationship between neuronal plasticity and musical exposure (Vik, Skeie, Vikane & Specht, 2018). The efficacy of community-based aerobics training for patients with mild to moderate severity of TBI has also been investigated in the rehabilitation of TBI. Studies have indicated that patients can benefit from a sustained exercise routine (Devine, Wong, Gervino, Pascual- Leone & Alexander, 2016).

IV. CONCLUSION

The primary purpose of this review paper was to integrate the recent trends in the rehabilitation of TBI, specifically focussing on the cognitive and vocational therapies used and also highlight the non-traditional methods in rehabilitation. Emphasis is given to cognitive and vocational therapies as these two are the core aspects of the rehabilitation plan for TBI. Further, with the advancement of research on TBI, new techniques have shown significant results. Therefore the paper aims to amalgamate the recent trends to have a ready knowledge base for the same. For cognitive therapies, the review highlighted that most of these techniques, irrespective of the severity of the TBI focussed on regaining or compensating for the cognitive deficits primarily seen in executive functioning. Concerning vocational training, it was observed that using techniques like assistive technologies and including neuropsychologists has been seen to be beneficial according to this review. Finally, trends like wilderness adventure training, music therapy, aerobics, and other such non-traditional methods are highlighted by this review.

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