Literature Review

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Traumatic Brain Injury

**Literature Review**

Traumatic Brain Injury (TBI) is a serious issue. In the United States, TBIs in excess of 1.7 million lead to 235,000 hospitalization cases every year, and approximately 3.2 people develop some disability. The estimated cost of Traumatic Brain Injury in the United States in the year 2000 was $60.4 billion; this cost was apart from the cost of care and some deficiency in life (Schneider et al., 2018). In the armed forces, mild TBI is called "signature wound" of the war in Afghanistan and Iraq. According to an estimate, 22% of soldiers who returned from these areas have sustained TBA during their duties (Gaitens et al., 2017). Traumatic Brain Injury may harm patients in the long-term. In this paper, different aspects of TBI are analyzed. The treatment of TBI is not easy. It is a complex disorder according to the sensitivity of the injury. In addition, diffuse axonal injury is hard to detect with traditional approaches. A few patients recover quickly, whereas others take quite a lot of time. In this respect, patients who make are considered to have been benefited from the process of vicariation, while neurons loss due to injury is essentially substituted by "redundant" neurons; however, the process itself is complicated to measure. In the overall context of TBI, three important concept; the overview of neurofeedback, vicariation, and Ayres findings are presented in this paper.

**Overview of Neurofeedback**

It is biofeedback of any measure of the brain function. The term neurofeedback refers to the utility of electroencephalogram (EEG) to generate biofeedback; however, there is a possibility of the use of more measurements, for example, blood oxygenation (Robbins, 2017). As a result of Neurofeedback, the overall symptoms have improved for patients alongside the history of mild TBI, but according to the previous studies, there were limitations that led to more research. This particular literature review was carried out to explore those suggestions further. During the practice of Neurofeedback, a visual signal is employed to facilitate patient to a strong EEG signal. This attitude has not been located to interrelate with subjective thought processes at patients' end. Also, the clear picture of the model and attention to the task are usually considered prerequisites.

Normally, the treatment is based on five to sixty sessions with a duration of half an hour to one hour, according to the condition of the patient and the way they respond to the intervention. Moreover, treatment can be supervised by a technician, and anecdotal suggests that motivation during training can help the patient a great deal. However, a procedure for interaction with patients has not been regularized. According to the research by Double-blind, Neurofeedback can be useful for the intervention of refractory epilepsy. Besides, it has side effects that remain for some hours following the treatment, and these are headache, dizziness, cognitive interferences, headache, destabilization, anxiety, and nausea. Neurofeedback is mostly facilitated through patients' quantitative electroencephalogram (QEEG). It gives power density measurement at every EEG level and measurement of consistency or density that relates between channels. In this regard, consistency and power measures at 64 frequencies in relation to 19channles give thousands of measures that may be the targets of biofeedback.

Target is selected through a normative procedure, developed from the QEEGs of health studies. In this respect, Neurofeedback has not got any fame in a clinical discipline. Inadequate empirical evidence and QEEG's non-diagnostic specificity are quoted as contributors to the experimental state. It is purely a technical treatment and makes fundamental adjustments during therapy and stays as an operator dependent procedure. The equipment of Neurofeedback is approved by FDA as relaxation devices, only and treatment of any particular disorder is demoted to off label use. Neurofeedback is standard in databases as far as medical publications are concerned. Neurofeedback uses the neuronal circuit of learning which has been displayed by functional magnetic resonance images. This is different from the entertainment episodes, whereas an audiovisual aid or electromagnetic fluctuates in the form of a wave which is the same as the patient's EEG. In these modalities, plastic changes are imagined to occur in reaction to a changed physiological act.

**Overview of Vicariation**

Vicariation is described in the motor or sensory loss perspective because of the cerebrovascular accidents, and the following recovery of function with the help of training as these functions are directly associated with recordable behavior. Some features of cognition can be observed as a result of the usage of EEG. The opening psychological trait leads to the process of Vicariation. However, the training time is less than the Vicariation tasks; the effects of EEF neurofeedback have been exhibited by QEEG (Harris-Love, & Harrington 2017). The operant would essentially depend on the network of vicarious neural to be spatially same to the pre-trauma configuration.

Vicariation has been in place for a long time, and it is a mechanism for the recovery of brain function that gets affected due to the injury. In this context, the concept refers to the capability of one portion of the brain to replace for the function of other. In the field of neuroscience, Vicariation has been the topic of discussion, and it was at the mid of a controversy called localization of function. The concept that another part of the brain can replace the function of the injured or affected area is somewhat hard to comprehend with the idea that specific functions are situated in specific regions of the brain.

In case, there is an isomorphic connection between the behaviors and neurological, how can the behavior get along with no side by side growth of neural tissues. Similarly, if other parts of the brain also have an isomorphic connection with different types of behavior, how one or more of neurological regions to replace new behavior? Therefore, the theory to replace the damaged part of the brain with the other functional one does not seem realistic.

**Overview of Ayers findings**

Ayres became the first person to report a positive outcome of EEG Neurofeedback for TBI-related symptoms. According to his reports, 250 patients were relieved in their post-concussive symptoms that included depression, dizziness, headache, memory loss for a short period (Thompson & Thompson 2015). According to the reports, QEEG got normalized also; but, no quantitative survey reports endorse this. However, more research was conducted to evaluate the positive outcomes of the published literature regarding the therapeutic efficiency of Neurofeedback for TBI and give suggestions for further research in this field.

The guidelines are issued collectively by the Association Biofeedback and Applied Psychophysiology to organize Neurofeedback researches. As a result of the inadequate published material, subjects with all stages of serious injuries are included. All comparisons, outcomes, reports, and designs were taken into account. Any treatment that includes operant conditions of the EEG is involved.

 One may like the findings of Ayres in the context of TBI-specific symptoms, but the question arises why his findings were not supported by the quantitative report surveys. The recommendations that were given about the more research should be considered. In order to evaluate the authenticity of any report, it should be cross-checked by other published literature and quantitative research. Finally, the recovery of the patient largely depends on the severity of the injury. Sometime severe injuries may take several years to recover, while the healing process for mild injuries may be less.

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