Research Article

Journal of Medical - Clinical Research & Reviews

An Approach to Diagnosis and Treatment of Mild Traumatic Brain Injury

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Received: 10 April 2018; Accepted: 04 May 2018

Citation: Joseph P. Leahy. An Approach to Diagnosis and Treatment of Mild Traumatic Brain Injury. J Med - Clin Res & Rev. 2018; 2(3): 1-2.

ABSTRACT

Our understanding of MTBI has evolved to more appreciate the centrifugal force, or rotational acceleration as a key damaging force. We are also coming to understand that the physiological damage is perhaps the most important aspect. This is not to diminish the importance of looking at the physical insult, and anatomical changes, but rather to appreciate that the physiological function is of course of paramount importance.

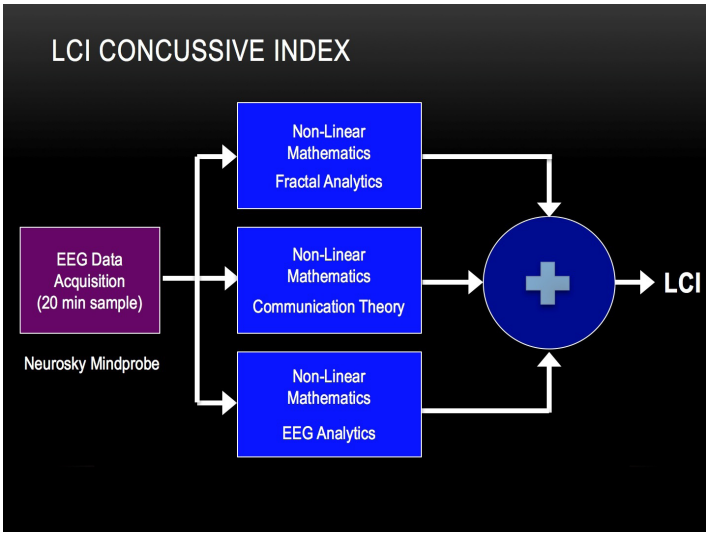
Advances in imaging, especially in Diffusion Tensor Imaging helped to visualize anatomical damage in the brain. Now we have developed a novel QEEG method that is proving to be accurate and reliable. But more importantly, we now have a treatment that is demonstrably effective. Patients with recent history of MTBI, and also patients with very long histories of multiple MTBI's were seen. Symptoms ranged the full gamut, including inability to concentrate without pain, memory problems, headaches, fatigue and pain upon exertion, emotional disturbances, etc. A single point EEG was done with each patient for 20 minutes; the data was analyzed using a unique combination of nonlinear equations producing and LCI (concussive index). Treatment was provided with Light MD's LED light therapy unit for 20 or 40 minute sessions. Several different protocols were needed depending on the severity and how recent the MTBI was. Most patients felt noticeably better after the first treatment, and all patients were significantly improved, if not symptom free after 10 or fewer sessions.

***Conclusion:** The consistent results of the EEG test demonstrate the need for further, larger scale study. The treatment results are the most encouraging, with most patients recovering, demonstrating the need for a larger scale study with more diverse testing included.*

Methods

Testing was performed with a single point EEG unit from Mind Wave Mobile. This unit allowed us to gather non filtered EEG data, over a 20 minute period for each patient. The patients were supine with eyes closed in a dimly lit room with little to no noise. The EEG unit was place over the head with the contact point at FP1. A Bluetooth connection was established with a remote computer which received approximately 650 thousand data points during a 20 minute session. The data was then analyzed using matlab and a proprietary combination of 3 types of stochastic equations. (Research has shown that linear equations do not give reliable results, and preliminary research has demonstrated that nonlinear equations do.)

Treatment consisted of LED light therapy using the Light MD unit. This unit allowed us to have a larger bandwidth of wavelengths, and pulse frequency modulation. We have found that certain combinations of wavelength and modulation frequency are too strong for the acute patient, and patients need to progress through a series of 4 different combination protocols in order to avoid flare ups, and allow complete healing. 20 minute sessions were used for more intensely symptomatic patients, and they were gradually moved to 40 minute sessions. Three flexible application pads of 200 LED lights each were connected and wrapped around the head covering the foramen magnum and EAM, as well as the posterior and lateral cranium. No pads were put over the eyes as one of the symptoms of MTBI is light sensitivity. LCI measurements were done after 10 sessions and after 20 sessions if those were needed. The analysis of the data was performed using Matlab, and this analysis type:



Discussion

Previous articles on QEEG such as a review in Clinical Neurophysiology by Nuwer et al., looked at QEEG analysis using linear equations, and looked at changes in amplitude, slowing of signals in certain bands, and the lack of correlation with symptoms, and especially with damage over time. We decided to take a different approach by using a single point EEG. In previous studies, a confounding factor was the location of injury, and inconsistency of the EEG signal as it related to the location, and symptoms. If we don't need to know where the damage is, but rather how much damage there is, then a single point EEG is preferred. In the analysis of the data, we decided to focus on factors such as changes in entropy. The three mathematical methods of analysis combined into one index allows us to measure how "disorganized" the EEG signal becomes after MTBI. We found that there is no one LCI that is "normal" for all subjects. Rather, each subject has a unique normal. For this reason, it would be better to have a screening, baseline LCI for each patient. When we do, we have found that the after injury LCI increased by more than 5%. Treatment then was provided until symptoms were resolved, and the LCI returned to normal. In the absence of a baseline LCI, treatment was provided until symptoms were resolved, and the LCI stabilized at the lower level [1-13].

Conclusion

There was a good correlation between the resolution of symptoms, and the return to normal, or stabilized LCI. Treatment was quite successful with most patients getting positive changes in symptoms after the first one or two sessions. All 10 patients were symptom free by the 10th session if not earlier, and their LCI's were down substantially, ranging from 9-25% from the initial, post injury test. Treatment seems to be quite effective. Our results suggest the need for a large scale study, on both the diagnostic method, and treatment method.

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