Novel Point-of-Care, Non-Invasive Mild Traumatic Brain Injury (mTBI) or Concussion Diagnostic Tool

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Over 50% of student football athletes sustain undetected concussions due to improper diagnosis, leading to increased risk of permanent brain damage. An EEG sensor and a diagnostic algorithm were created and embedded into a helmet for immediate, on-the-spot diagnosis. The sensor transmits brainwave data into the algorithm, which identifies concussive patterns involving an epileptic spike followed by an isoelectric period. When these patterns occur, the algorithm makes a positive concussion diagnosis and LED lights around the helmet are turned on in order to alert every one of the concussion. The accuracy of the diagnostic tool was determined using an ROC Curve with the area under the curve (AUC) being a measure of accuracy, the closer to 1.0 the more accurate. In the first iteration, the experimenter represented the true negative concussion case. An EEG database modified to incorporate concussive patterns represented a true positive concussion case. The AUC was 1.0, perfect; however, the EEG sensor provided insufficient brainwave data due to a slow sampling rate. Likewise, movement with the EEG sensor and subjects in different age/gender groups were not tested, but can affect the data. To address iteration 1's problems, a reliable EEG sensor was created with a sampling rate of 16 MHz, and the helmet was tested on subjects in different age/gender groups while performing football drills. The AUC remained high (.99) despite more realistic testing. This immediate, on-the-spot concussion diagnostic tool can prevent undetected concussions in athletes, and prevent possible permanent brain damage following repeated, undetected concussions.

Awards Won:

Third Award of $1,000