Development of an Electroencephalography (EEG) Device for Evaluation of Mild Traumatic Brain Injury, Year Two

Benedict, Braeden

The effect of concussions on brain wave patterns was studied with a novel prototype device, incorporating a simple electroencephalography (EEG) headset, to assess its potential for concussion diagnosis. A secondary goal was to examine long-term effects of concussions on youth. This device was built by integrating a Mindflex game single-electrode EEG headset with an Arduino microcontroller. Bluetooth functionality and touch screen were added. Data for 8 brain wave frequencies were collected and analyzed. Brain wave activity for a control group of 95 healthy “baseline” subjects was recorded with subjects in states of attention and relaxation/meditation. Some were also monitored during cognitive testing. The recoveries of 18 recently concussed subjects were tracked using EEG data from the device and C3 Logix iPad concussion testing. An additional 25 baseline and 9 concussed subjects were tested with the Emotiv EPOC, a 16-electrode EEG headset. Results showed concussions influenced brain wave activity; patterns for concussed subjects while relaxing/meditating were significantly altered compared to when these subjects were not concussed. Amplitudes of beta and high alpha frequencies were also reduced after a concussion. As subjects recovered, these approached normal levels. Concussed subjects tested with the EPOC headset also displayed characteristic changes. Finally, baseline subjects who sustained a concussion months or years prior to testing displayed similar deficiencies, on average, as subjects who had recently sustained concussions. This key finding indicates concussions have residual effects in youth. Further development of this technology may provide a simple, affordable, and rapid sideline concussion diagnosis device, a major breakthrough for concussion management.

Awards Won:

Third Award of $1,000