

## Music and the Brain: Can music help people with epilepsy?

Epilepsy is the condition of having recurrent seizures and is associated with dysfunction in the frontal and temporal cortices and dysfunctional electrical activity in the brain. The purpose of this study is to determine whether or not brain electrical activity in persons with epilepsy may synchronize with music differently than persons without epilepsy. The cerebral cortex is histologically organized into long columns of cells. This arrangement amplifies the voltages generated by post synaptic potentials to the point that they can be measured through the skull, which is the basis of electroencephalogram (EEG). The voltage of a given cell column over a brief time period can be best approximated by a linear summation of cosine waves with many amplitudes, frequencies and phase angles. We can elucidate the amplitude, frequency and phase angle of each cosine wave with Fourier spectrum analysis. The electrical activity of these cortical cell columns can synchronize, which greatly increases the amplitude of EEG activity. Profound electrical synchronization between cell columns is the basis for generation of epileptic seizures. Synchronization between frequency pairs (cell columns) in EEG can be detected by bispectrum analysis. We recorded EEG in 21 consecutive patients admitted to the epilepsy monitoring unit. We recorded EEG in people with and without epilepsy at rest and while listening to music. We used bispectrum analysis in conjunction with Fourier analysis to determine the degree and distribution of synchronization. We found significantly higher levels of synchronization and spectral EEG activation when listening to music in the frontal cortex and temporal cortex, especially in persons with epilepsy. We speculate that music may be useful to enhance electrical activity specific to the frontal and temporal cortices.