



Information Bulletin

What is Brain Mapping?

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What is Brain Mapping ?

Physical injury to the brain, such as concussion, disrupts normal flow of electrical impulses in the brain tissue. Similarly, toxic injury, seizure disorder, Alzheimer's disease, anoxia and brain infection (e.g., chronic Lyme encephalitis) alter brainwave activity. ADD, OCD, anxiety, depression and Learning Disability have distinct brainwave "signatures."

EEG (or electroencephalogram) is a recording of brainwave activity. QEEG (Quantitative EEG), popularly known as brain mapping, refers to a comprehensive analysis of brainwave frequency bandwidths that make up the raw EEG. QEEG is recorded the same way as EEG, but the data acquired in the recording are used to create topographic color-coded maps that show electrical activity of the cerebral cortex.

While other brain imaging techniques (e.g., CT, MRI, PET, SPECT) measure such properties as cerebral blood flow, metabolism or structural integrity, QEEG measures electrical activity of the brain. It provides complex analysis of such brainwave characteristics as symmetry, phase, coherence, amplitude, power and dominant frequency. In fact, subtle disruptions of electrical connectivity and flow

in the brain sometimes may be the only or the early signs of a problem.

The QEEG findings are then compared to a normative database. This database consists of brain map recordings of several hundred healthy individuals. Comparisons are displayed as Z scores, which represent standard deviations from the norm.

The primary use of QEEG is to examine patterns of brainwaves and help determine whether a person is an appropriate candidate for Neurofeedback, a treatment that normalizes brainwaves. QEEG does not render a diagnosis, but is designed to help the clinician to make a diagnosis. QEEG is not a substitute for EEG; it is a different process than that carried out by the neurologist when he or she performs an EEG assessment. Medical illness of the brain, such as seizure disorder, dementia, encephalopathy, brain tumor, lesion, haematoma and aneurysm should be diagnosed by a physician.

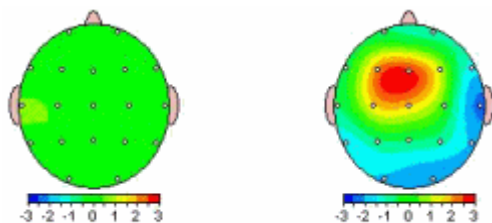
How is it Done?

An elastic cap with 19 sensors is placed on the head and the sensors are connected to the recording device. A special conductive gel is squeezed into each of the 19 sensors in the cap. This preparation takes approximately 15 minutes. The actual recording might take from 10 to 30 minutes.

A patient may be instructed to keep his eyes open or closed during parts of the recording, or asked to perform a mental task, such as reading or simple math. It is important to sit very still during the recording.

Reading the Maps

QEEG results are presented as Z scores. Z scores represent Standard Deviations (SD) from the norm and span from -3 to +3. Thus a Z score of +2 means that the result is 2 Standard Deviations higher than the norm (+2SD) and exceeds 98% of the age-matched people in the normative sample. A Z score of 0 represents the norm and is color-coded green. Red and blue colors on the maps show brainwave activity that is 3 SDs above or below the norm.



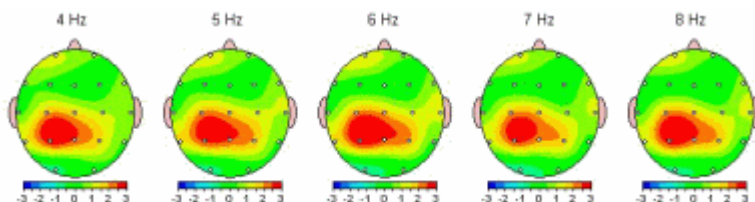
Green - Normal Red = Excessive Blue = Diminished Activity

The following examples show different ways in which QEEG can be useful in diagnostics and treatment, as well as evaluation of treatment effectiveness.

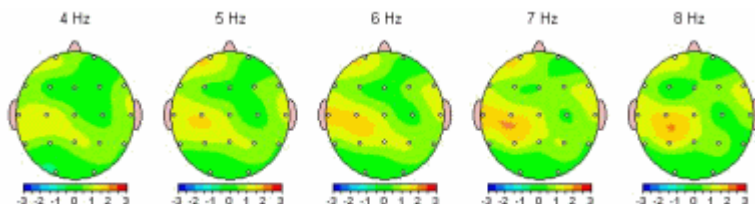
Example 1

Excessive Theta waves (4-8 Hz) at the central & left parietal area due to traumatic brain injury, presented in 1 Hz slices. Red color represents increased slow wave activity at the site of the injury.

Before Neurofeedback Treatment:

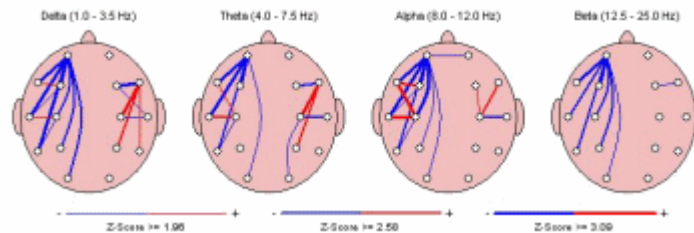


After Neurofeedback Treatment:



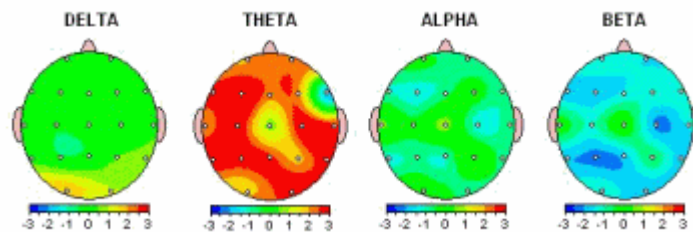
Example 2

Diminished coherence in the left hemisphere after a concussion to the left frontal area. Blue lines show reduced neural connectivity.



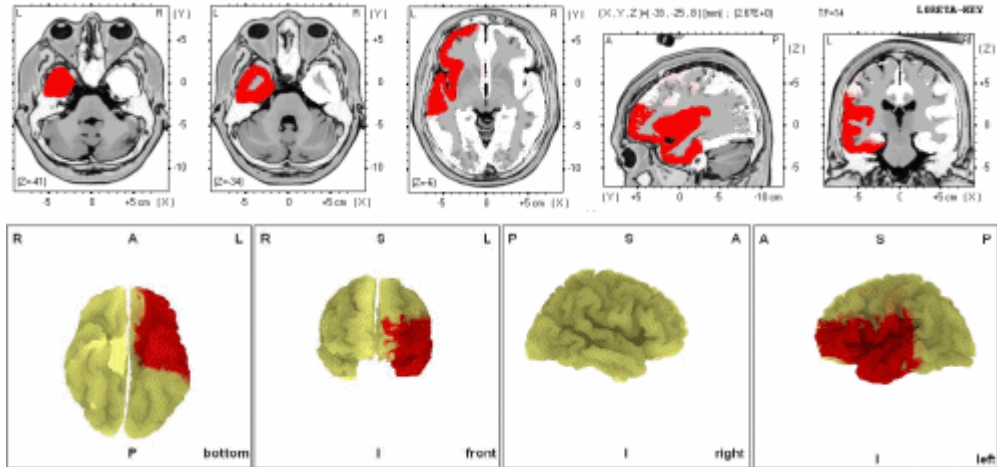
Example 3

Typical ADD signature: excessive generalized Theta and diminished Beta.



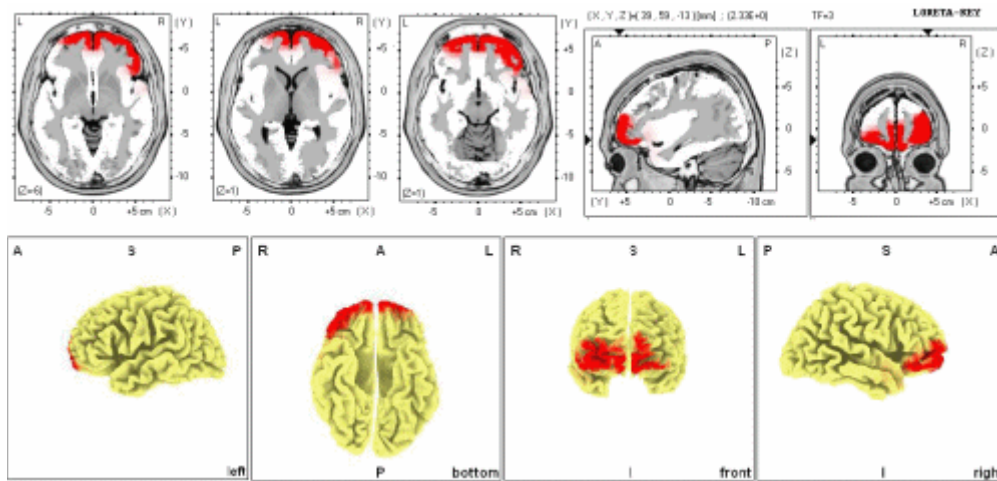
Example 4

QEEG combined with LORETA (Low Resolution Electromagnetic Tomography) enables examining of deep structures of the brain slice by slice, as well as viewing 3-dimensional models of the brain. Here is asymmetrically increased slow wave activity typical of depression: too much Alpha and Theta (red) on the front left side.



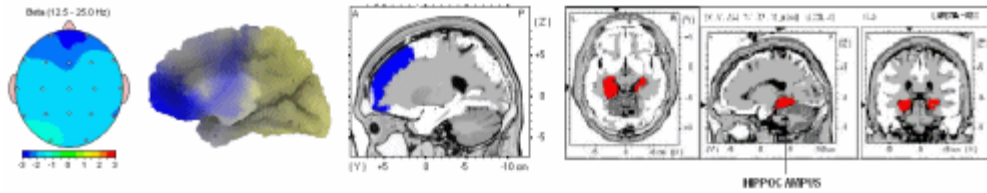
Example 5

Increased slow wave (Theta) activity in the Frontal Lobes commonly seen in ADD.



Example 6

Seen here are diminished fast Beta waves in the Frontal lobes (blue) and excessive slow Theta waves in the Hippocampus (red), indicative of the early stages of Alzheimer’s disease.



Some Technical Considerations

Although QEEG may render lots of useful information it has its limitations and possible pitfalls. For example, it is important that raw data that are digitized and analyzed by the computer are free from artifacts, which are electrical signals produced by something else than the brain, such as muscles or improper electrode placement. Therefore, the person that performs the recording and data analysis should be well trained in artifact recognition. There is also some debate about the several normative databases that are currently on the market. Some of them have larger sample size or age span than others. They also use somewhat different inclusion criteria for “normalcy” and different mathematical procedures for data analysis.

Clinicians that are considering QEEG in their practice are often faced with complex choices of multi-channel EEG recording devices, data analysis software programs and normative databases. Internet resources such as the International Society for Neuronal Regulation www.insr.org (International Society for Neuronal Regulation) may be helpful in providing information or journal articles describing relative merits of various systems.

At Northeast Center for Special Care we use Mindset 24 recording device. We found it to be a reliable and sensitive instrument that produces very clean recordings. For data analysis we use Neuroguide software with Dr. Robert Thatcher’s Lifespan normative database, which consists of 625 subjects from two months of age to 82.3 years of age. We also use LORETA (Low Resolution Electromagnetic Tomography) which allows for 3-dimensional electrical source localization analysis.

The Place of Brain Mapping in the Overall Assessment

It is important to remember that QEEG is just one part of the overall assessment. QEEG, along with MRI, SPECT or CT scans is an imaging

technique and, as such, it does not describe cognitive or emotional problems in functional terms. While very good at pinpointing problem locations in the brain it cannot say how much cognitive functioning is diminished at that location. For example, QEEG may show reduced electrical activity in the Hippocampus area, which is associated with memory storage and retrieval. Neuropsychological testing, on the other hand, may reveal that an individual's short term auditory memory is at the 9th percentile of functioning.

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