



Standard Report

Quantitative Electroencephalogram (EEG), **Event Related Potential (ERP)** and Biofeedback /Physiological Measures

Analysis, Summary, and Recommendations

For

<Insert Date>

This is a standard report which summarizes the several assessment data collected from you and makes recommendations for potential treatment at Stable Roots Therapy, as well as practices that you can do at home.

We offer innovative neuroscience-informed, connection-focused counselling and therapy services for children, youth, and adults. Our unique services include options such as farm-based & nature-based therapy, play therapy, in-office psychotherapy, equine facilitated wellness, and neurotherapy. The ultimate goal is to enhance client wellbeing.



Table of Contents

1.	CLIENT BACKGROUND INFORMATION.....	1
2.	PRESENTING SYMPTOMS AND MAJOR CONCERNS.....	1
3.	QUANTIFICATION OF THE EEG AND BIOFEEDBACK/PHYSIOLOGICAL MEASURES.....	2
4.	RECORDING AND ANALYSIS OF THE EEG/ERP.....	2
5.	ASSESSMENT FINDINGS.....	2
A.	Personal Wellness Ratings	
B.	Physiological Stress Test	
C.	Heart Rate Variability and Sympathetic/Parasympathetic Levels	
D.	EEG Findings (surface and cortical)	
a.	Raw EEG (EO and EC)	
b.	Surface Maps, Coherence, Phase Lag, Power Ratios, Peak Alpha, Comodulation (EO and EC)	
c.	Cortical Maps (EO and EC)	
E.	TBI Discriminant Analysis	
F.	EEG Network Findings (EO or EC)	
G.	ERP Finding	
H.	ICA Findings	
6.	SUMMARY AND RECOMMENDATIONS	12
7.	APPENDIX – Definitions and Basic Explanation of Brain Waves	13



1. CLIENT BACKGROUND INFORMATION

Name: _____

DOB: _____

Age: _____

Sex: _____

Handedness: _____

Medications/supplements which may affect the EEG and physiological findings:

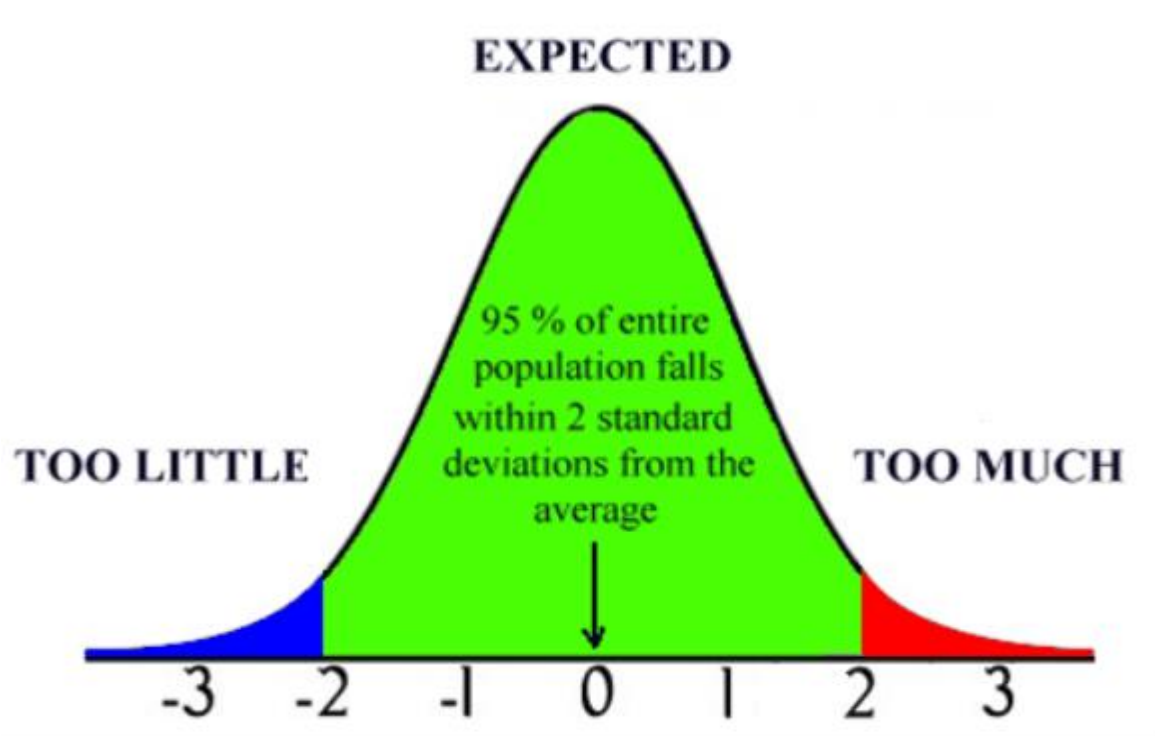
2. PRESENTING SYMPTOMS AND MAJOR CONCERNS

<insert summary here>

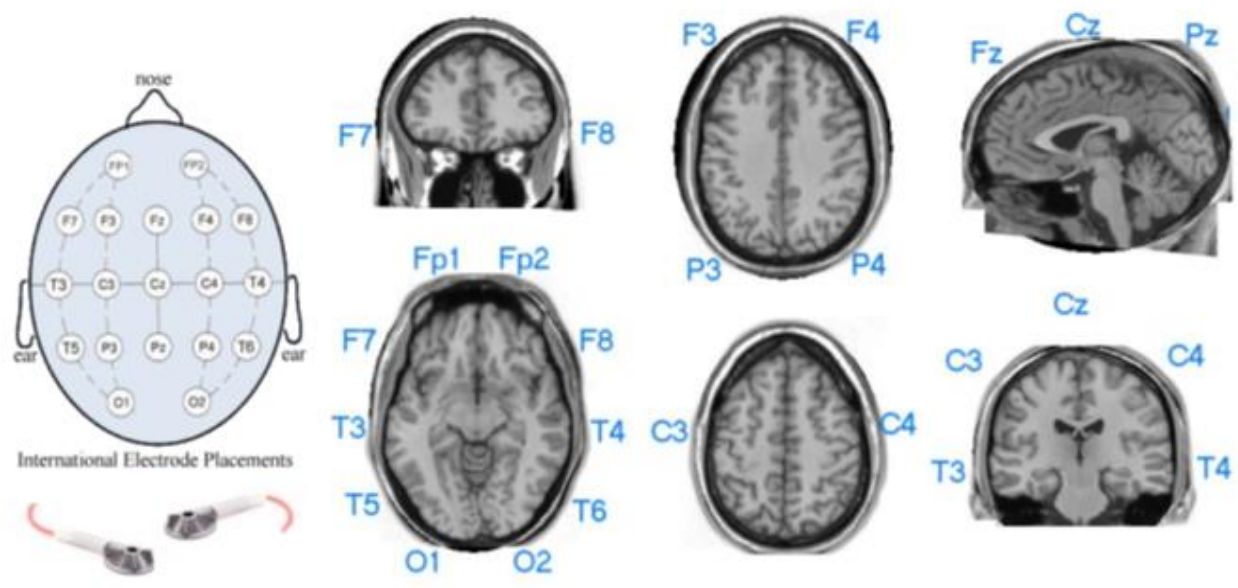
3. QUANTIFICATION OF THE EEG AND BIOFEEDBACK MEASURES, AND COGNITIVE/PSYCHOLOGICAL ASSESSMENTS

Electroencephalogram (EEG)

A quantitative EEG (QEEG) is a test comparing the electroencephalography of the individual (EEG) to a normative database. The individual is then assessed from the perspective of how many standard deviations (SDs) from or within the “normal” distribution (comparable age-based and demographic sample) their brain data occurs. In the brain map, green is considered “normal” while excesses are red and deficiencies are blue (both more than 2 SDs from the norm).



The international 10-20 system for electrode placement is used and electrode impedance of less than five kilo ohms is used. Activity at the functional regions of the brain, including Brodmann areas (BAs) are incorporated into the findings with the use of Low-Resolution Brain Electromagnetic Tomography (LORETA) software.



BIOFEEDBACK MEASURES



Since the brain and body are intricately connected, it is important to also collect physiological data. The Thought Technology system is used with the BioGraph Infiniti encoder. Sensors are placed on the thumb (to measure heart rate/pulse), shoulder (to measure muscle tension), around the waist (respiration), pointer and ring finger (skin conductance - sweat), and pinky finger (skin temperature).

During one of the EEG recordings we also attach a tin sensor to just below the bottom left rib in order to measure heart rate variability, and sympathetic and parasympathetic levels.

4. RECORDING AND ANALYSIS OF THE EEG/ERP

A 19 channel EEG is recorded using either a BrainMaster Discovery 19 or a Neurofield Q20 EEG amplifier. The EEG is recorded in two conditions, eyes open and eyes closed. The data are analyzed using various Z-score normative databases (QEEGPro, NeuroGuide, Neurofield) and software programs (such as the Neurofield EEG and ERP programs, EEGLAB in MATLAB, WinEEG Independent Components Analysis, and LORETA 3-D inverse mapping solution). Data are also analyzed in various montages such as Linked Ears referential, Average Reference, and a Laplacian.

Specific definitions can be found in the appendix.

Recording Date: [REDACTED]

Recording Type and Length: EEG: [REDACTED], ERP: [REDACTED]

5. ASSESSMENT FINDINGS

A. Personal Wellness Ratings: Personal wellness ratings are completed on a 1-10 scale with 10 being the best/most desirable.

Sleep – [REDACTED] Exercise – [REDACTED], Diet – [REDACTED], Social – [REDACTED], Technology Use – [REDACTED]

A. Physiological Stress Test: This is a psychological stress test to note changes in physiological responses while at rest, and during stress and recovery periods. This information can help clients to realize the connection between the brain and body.

In addition, it indicates the type of stress response the client has, and how long it takes for the physiology to recover.

<insert image here>

Baseline, Stroop Test, Recuperation1

<insert commentary here>

<insert image here>

Recuperation1, Math Test, Recuperation2

<insert commentary here>

<insert image here>

Paced Breathing, Recuperation3

<insert commentary here>

- B.** Heart Rate Variability (HRV) and Sympathetic/Parasympathetic Levels:
HRV is associated with overall health and wellness. Sympathetic levels tell us how much your body is in “fight or flight” response, while parasympathetic levels tell us your body’s level of “rest and digest”.

<insert image here>

<insert commentary here>

The patient’s average heart rate is about █ beats/min. The LF (Low Frequency), the yellow bar, is primarily produced by the sympathetic nervous system (SNS). The HF (High Frequency), green bar, is primarily produced by the parasympathetic nervous system (PNS). In this case, the sympathetic/parasympathetic █

The SDNN is █ ms which is █ normal range (normal 50-100 ms) and indicates that the heart is not as adaptable and flexible.

C. Significant EEG Findings (Surface and Cortical): The EEG findings are based on approximately 5 minutes of each eyes open (EO) and eyes closed (EC) resting state conditions, using a 19-channel cap and the either the Discovery24 or Q21 amplifier. A 60Hz lowpass filter is used.

a. Raw EEG (EO) (Average Reference Montage)

<insert EO image here>

EO Artifact – _____ eye blinks and _____ lateral eye movement (for example, see _____ channels between the _____ and _____ sec. marks).

Background Rhythms – The predominant rhythm is _____ amplitude _____. There _____ alpha attenuation in the EO condition.

Raw EEG (EC) (Average Reference Montage)

<insert EO image here>

EC Artifact – _____ lateral eye movement (for example, see _____ channels between the _____ and _____ sec. marks).

Background Rhythms – The predominant rhythm is _____ amplitude _____. There _____ alpha bursts in the EC condition.

b. Surface Maps, Coherence, Phase Lag, Power Ratios, Comodulation (EO)

<insert EO images here>

- some _____; _____ coherence across the _____ band and hyper-coherence across the _____ band, with _____ phase lag in the _____ band (related to inefficient brain functioning); Power Ratios show _____; some Comodulation in _____ areas (related to cognitive inflexibility)

Surface Maps, Coherence, Phase Lag, Power Ratios, Comodulation, Peak Alpha (EC)

<insert EC images here>

- some _____; _____-coherence across the _____ band and hyper-coherence across the _____ band, with _____ phase lag in the _____ band (related to inefficient brain functioning); Power Ratios show _____; some Comodulation in _____ areas (related to cognitive inflexibility); peak alpha (_____, _____, _____, respectively) (which is an indication of the brain's ability to take in and process information)

c. Cortical Maps - sLORETA (EO)

<insert EO images here>

Cortical Maps – sLORETA (EC)

<insert EC images here>

<insert commentary for both EO and EC here>

D. TBI Discriminant Analysis (EC)

<insert image here>

E. EEG Network Findings (EO or EC): It is important to examine how the brain functions as a unit, and not just the individual lobes or Brodmann Areas. Below are the most significant reports (_____ networks)

<insert images here>

F. ERP Finding (Visual or Auditory): The ERP provides information about how the brain functions under task, not at rest. The number of trials for this test was _____.

<insert images here>



- [REDACTED]

** Please note that this report is for clinical purposes (planning and progress monitoring) and is not diagnostic.

Kim Calder Stegemann, Ph.D., M.Sc., M.A.
Certified in QEEG Analysis (QEEG-Diplomate)
Certified in Neurofeedback (BCIA -)
Certified Clinical Counsellor (CCPA)

APPENDIX

Definitions

- Absolute Power - Absolute power is the total voltage, or energy, that the brain is emitting, measured in disparate frequencies.
- Heart Rate Variability (HRV) - HRV is a measure of the difference between heart beats when you breathe in and when you breathe out; it is associated with overall body and brain health. If one has good variability / flexibility, their body can be more resilient to stress.
- Independent Components - Independent components are spatially and spectrally independent patterns in the brain, which are used foremost in sourcing content.
- Parasympathetic Levels - As part of the autonomic nervous system, the parasympathetic system is your relaxation response and is responsible for regulating the “rest and digest” functions. It’s more active during periods of rest, sleep and is active when your body is healing. Too much parasympathetic activity can lead to a “freeze or feign” response.
- Phase - Phase is any one point or portion in a recurring series of changes, as in the changes of motion of one of the particles constituting a wave or vibration.
- Relative Power - Relative power is a measure of clients’ EEGs, viewed in relation to their absolute power profile, comparing each brainwave amplitude to the others.
- Sympathetic Levels - As part of the autonomic nervous system, the sympathetic system is responsible for the “fight or flight” response. It manages increases in heart rate and blood pressure in stressful situations.

Basic Explanation of Brain Waves (Adapted from [REDACTED])

- Delta



Delta brainwaves are the slowest in frequency and represent a state of deep dreamless sleep or unconsciousness. Delta brainwave states have long been associated with healing during comas and while in shock. While Delta brainwaves usually only occur in deep sleep, if Delta is present while awake it may represent areas of traumatic brain injury (TBI) or dysfunction. Also, if Delta is present during a QEEG exam it may indicate artifact due to nervous eye movement which would force the examiner to discount delta information. The Delta brainwave state normally corresponds to frequencies from 0Hz to 4Hz indicated by many neurophysiology references.

- Theta

Theta brainwaves are another slow wave in frequency and represent a state of internal focus, deep relaxation, meditation, enhanced creativity, stress relief, light sleep and dreaming. Theta brainwave states have been used in meditation for centuries. However, elevated levels of theta while engaged in cognitive activities indicate attention deficits and focus on the internal milieu rather than externally focused on subjects at hand. The Theta brainwave state normally corresponds to frequencies from 4Hz to 8 Hz indicated by many neurophysiology references.

- Alpha

Alpha brainwaves are considered another slow frequency and represent a state of relaxed mental awareness or reflection without processing. Alpha brainwave states are typically associated with contemplation, visualization, problem solving and accessing deeper levels of creativity. However, if present during cognitive tasks indicate brain areas which are idling or not processing when they should be. This is illustrated by the alpha amplitude change in the occipital and parietal lobes during eyes closed vs. eyes opened tasks. When the eyes are closed the alpha amplitude is greater because the visual association areas in the rear of the brain are idling due to the lack of visual input. As soon as the eyes open the alpha amplitude drops by 30% to 50% because all of the visual association areas become active. This phenomenon is called alpha blocking. It is typical to see high alpha frequencies during cognitive tasks in the frontal lobes of substance abusers because even though they try to accomplish executive control tasks the associated neurons idle and can't get up to speed to perform. The Alpha brainwave state corresponds to frequencies ranging from 8 Hz to 12 Hz in most normal subjects.

- Lo-Beta or SMR

The Lo-Beta brainwave state is associated with efficient cognitive processing at a low level. Lo-Beta is called SMR when measured at the Sensory/Motor Cortex (C3/C4). At the Sensory/Motor Cortex increases in SMR amplitude have been proven to increase focus, and body/mind connection. When a person falls asleep, they start by entering alpha, then theta and finally delta. Within a few hours of entering delta the brain



awakens and enters REM sleep. If SMR is not sufficient to keep the body in a resting state then the person will awaken. This may be one of the causes of insomnia. Increasing SMR and Beta frequency amplitudes along the Sensory/Motor Cortex has been proven to help regulate unstable brain wave patterns and is the prime application for the treatment of attention issues. The Lo-Beta or SMR brainwave state corresponds to frequencies ranging from 12Hz to 15Hz and may be lower in children depending upon where their alpha frequency ends.

- Beta

The Beta brainwave state is associated with a heightened state of alertness and focused concentration. When the mind is actively engaged in mental activities, the dominant brainwave state will be Beta. A person in active conversation, playing sports or making a presentation would be in a Beta state. The Beta brainwave state corresponds to frequencies ranging from 15Hz to 23Hz.

- Hibeta

The Hibeta brainwave state is associated with an extremely heightened state of mental activity. A person in argument, extreme physical or mental competition, or in deep problem solving would be in a Hibeta state. Also, people who are anxious or have sympathetic nervous system dominance are continuously in a HiBeta state. It is inappropriate to demonstrate Hibeta brainwaves in a relaxed state and suggests overuse of neuronal faculties making them unavailable for new tasks called on by the individual. The Hibeta brainwave state corresponds to frequencies ranging from 23Hz to 38Hz.

- Gamma

Gamma brainwave states are the most rapid in frequency. They have received the least attention and research, although more attention is currently being paid to them than in years past. Research has indicated at moments when bursts of insight or high-level information processing occur, there are corresponding increases in brain activity in the Gamma range. The Gamma brainwave state corresponds to frequencies of 38Hz or higher.