Integrating Quantitative Electroencephalography in Clinical Practice

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DISCLOSURE

I have no relevant financial or nonfinancial relationships relevant to the content that I am presenting

Gary J. Schummer
Neuroimaging techniques

Electroencephalography (EEG)
functional magnetic resonance imaging (fMRI),
positron emission tomography (PET),
magnetoencephalography (MEG),
nuclear magnetic resonance spectroscopy (NMR),
electrocorticography, single-photon emission computed
tomography (SPECT),
near-infrared spectroscopy (NIRS)
event-related optical signal (EROS).
In what ways is EEG superior to other neuroimaging techniques?

1) EEG has a history of acceptance and is taught in medical schools; then, followed-up in residency training for neurologists; also, comparatively easier to find technologists.

2) Equipment is less bulky and less expensive (by several tons and several million dollars in some cases).

3) Modern EEG data collection systems record at sampling rates above 20,000 Hz, if desired, giving EEG very high temporal resolution.

4) EEG is relatively tolerant of subject movement and there are methods for minimizing and sometimes eliminating movement artifacts.
5) EEG is silent, allowing for better study of the responses to auditory stimuli.
6) EEG does not aggravate claustrophobia.
7) EEG does not involve exposure to high-intensity magnetic fields or radioactive substances.
8) EEG is extremely non-invasive.
9) EEG can detect covert processing (i.e., processing that does not require a response)
10) EEG can be used in subjects incapable of making a motor response
11) EEG can be recorded when the subject is not attending to the stimuli.
12) EEG and ERP can measure and elucidate stages of processing or states of consciousness on a dynamic continuum, not just the final end result.
13) EEG is highly reliable and a powerful tool for tracking brain changes during in the stages of life, the timing of brain development and degree of maturation.
14) Having been studied since the 1930’s, the EEG is a better understood signal, in terms of what is being measured, compared to other techniques.
15) EEG is sometimes more sensitive to subtle impairments then more expensive neuroimaging tests (ex., MRI)
Quantitative EEG (QEEG)…. 

….also known as brainmapping, is a method of measuring and analyzing brain electrical activity from the cerebral cortex. QEEG provides a standardized way to measure electrical energy (power) within familiar frequency bands (delta, theta, alpha, beta).

Used to estimate the probability that certain measurements in the EEG reflect abnormalities, instabilities, or deficiencies in proper communication pathways necessary for optimal brain functioning.
Therapists in our field do not agree on:

✓ which frequencies are important to train,
✓ which areas of the brain should be targeted,
✓ proper degree of interaction between the therapist and patient,
✓ the importance of integrating biofeedback devices or other types of therapy, and
✓ the frequency per week and duration of time for training sessions….

…so, it should be no surprise
The QEEG lacks agreement on:

✓ choice of reference electrode placement,
✓ defined bandwidths,
✓ the utility of certain analyses,
✓ length of time for a recording,
✓ best method for artifacting data,
✓ database selection parameters, and;
✓ even the usefulness of the QEEG itself.
We are a diverse group!

Some use the QEEG as a tool in treatment planning to determine parameters of various protocols,

Some use the QEEG continually in what is called Z-Score training,

Some don’t use the QEEG at all, and;
One expert: “It is unethical to do neurofeedback without a QEEG.

What is fascinating…

...Everyone gets good results.
Complex fields embrace the fact that there are many pathways to advance ones’ goals

• The key to progress is to view differences as complementary and avoid creating or focusing on simplistic and artificial ideas.

• You don’t come against another professional’s ideas with indignant adversarial pronouncements.

• You present your ideas based on evidence.

• Which brings me to a disclosure that is more important for you to know than my financial disclosure.

• In the spirit of the father of clinical neurofeedback, my mentor, who said

  “Show me the data”

• I am grounded in the theoretical foundation set down by M. Barry Sterman
Theoretical underpinning for how neurofeedback works
or
The neurophysiological basis of efficacy for neurofeedback

Thalamus

(from Greek θάλαμος = bedroom, chamber)
Constitutes the main part of the diencephalon
“The gateway to the cortex”
Implanted Electrodes and EEG at the Cortical Level
Thalamocortical Axis or Radiations
fibers between the thalamus and the cerebral cortex

Figure Legends
FIG. 1. Diagrammatic representation of thalamic relay nuclei organization. Primary afferent axons form dedicated sensory and integrative pathways (tracts) which project to thalamic relay nuclei. Thalamic relay cells, in turn, send their axons in functionally organized "radiation" pathways to layer IV of the cortical areas where this information is organized for conscious awareness and functional integration. En-route to the cortex, thalamic relay cell axons send collateral branches into the adjacent region of the Thalamic Reticular Nucleus (TRN), also referred to as nucleus Reticularis Thalami. The TRN cells, in turn, send their axons back to the relay cells which activate them. Finally, pyramidal cells in layer VI of the receiving cortical area send information back to both the same thalamic relay and TRN cells. (From Sherman and Guillery, 1996)
Global thalamocortical geometry and white matter anatomy of a normal human brain obtained by means of diffusion tensor imaging (DTI).
Training strategy

generalized vs focal abnormalities

• Generalized abnormalities (not due to diffuse metabolic or toxicity problems) probably represent dysfunction of thalamic generators for the given rhythm. Training is indicated at C3, Cz, and C4.

• Focal abnormalities are more likely to represent localized cortical abnormalities than thalamic dysfunction.
Hudspeth Relative Power Z-Score of a 17 yr. old with AD/HD (Beta) and Conduct Disorder

**RELATIVE POWER:**

A. Z-SCORE RELATIVE POWER

<table>
<thead>
<tr>
<th></th>
<th>F1</th>
<th>F2</th>
<th>F7</th>
<th>F8</th>
<th>F9</th>
<th>Fz</th>
<th>F4</th>
<th>T3</th>
<th>T4</th>
<th>C3</th>
<th>Cz</th>
<th>C4</th>
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<th>P4</th>
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<th>O2</th>
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<tbody>
<tr>
<td>DELTA</td>
<td>-1.25</td>
<td>-1.22</td>
<td>-1.43</td>
<td>-1.37</td>
<td>-1.41</td>
<td>-1.51</td>
<td>-1.61</td>
<td>-1.89</td>
<td>-2.03</td>
<td>-1.20</td>
<td>-1.39</td>
<td>-1.59</td>
<td>-1.51</td>
<td>-1.84</td>
<td>-1.39</td>
<td>-1.57</td>
<td>-1.75</td>
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<td>-1.53</td>
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<td>THETA</td>
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<td>-1.37</td>
<td>-1.45</td>
<td>-1.56</td>
<td>-1.67</td>
<td>-1.81</td>
<td>-1.66</td>
<td>-1.16</td>
<td>-1.35</td>
<td>-1.54</td>
<td>-1.47</td>
<td>-1.66</td>
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<td>-1.43</td>
<td>-1.51</td>
<td>-1.27</td>
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<tr>
<td>ALPHA</td>
<td>0.06</td>
<td>0.06</td>
<td>0.11</td>
<td>-0.04</td>
<td>0.02</td>
<td>0.18</td>
<td>0.35</td>
<td>0.02</td>
<td>0.45</td>
<td>-0.28</td>
<td>0.00</td>
<td>0.29</td>
<td>0.60</td>
<td>1.05</td>
<td>0.32</td>
<td>0.58</td>
<td>0.84</td>
<td>0.41</td>
<td>0.87</td>
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<tr>
<td>BETA</td>
<td>2.15</td>
<td>2.14</td>
<td>3.26</td>
<td>3.19</td>
<td>3.42</td>
<td>3.38</td>
<td>3.35</td>
<td>2.67</td>
<td>2.64</td>
<td>3.79</td>
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<td>3.39</td>
<td>2.33</td>
<td>2.19</td>
<td>3.34</td>
<td>2.99</td>
<td>2.63</td>
<td>2.44</td>
<td>1.74</td>
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B: RELATIVE POWER AND Z-SCORE TOPOGRAPHIES

**DELTA (0.5–3.5 Hz)**  
**THETA (3.5–7 Hz)**  
**ALPHA (7–13 Hz)**  
**BETA (13–22 Hz)**

- **DELTA (0.5–3.5 Hz):** The topography shows a significant increase in power in the frontal regions, particularly the F3 and F4 electrodes. The Z-score map indicates a high Z-score in the frontal regions, suggesting a strong relative power in the delta frequency range.
- **THETA (3.5–7 Hz):** The power distribution is more widespread with a peak in the central regions. The Z-score map shows a moderate increase in the central region, highlighting the theta activity.
- **ALPHA (7–13 Hz):** The power is concentrated in the central and posterior regions, with the highest power observed near the central electrodes. The Z-score map indicates a high Z-score in these areas, reflecting strong alpha activity.
- **BETA (13–22 Hz):** The power is highest in the frontal regions, particularly around the F3 and F4 electrodes. The Z-score map shows a moderate increase in the frontal regions, indicating a strong relative power in the beta frequency range.
M. Barry Sterman, Ph.D. (1994)..... relates the generation of field potentials at scalp level to the influence on the thalamus of three integrative activities of the brain he calls 1) vigilance, 2) sensorimotor integration, and 3) cognitive integration. The vigilance system involves diffuse networks and specific centers in the brainstem and their ascending influence on thalamic, subcortical and cortical centers. The sensorimotor system involves the ascending touch and proprioceptive pathways and their projections to thalamus and on to sensorimotor cortex, and the efferents from this cortical area. This system generates the sensorimotor rhythm (SMR), the 12 to 14 Hz rhythm over the sensorimotor strip. Cognitive integration involves a range of centers that process and integrate sensory inputs and motor responses.
The neurofeedback field is comprised of a diversity of experts..... **To facilitate the advancement of our field, a “best practice” model has been promoted that includes a proper understanding and integration of quantitative electroencephalography (QEEG).**
What does “best practice” mean?

A commitment to using the best practices in any field is a commitment to using all the knowledge and technology at one's disposal to ensure success.

In healthcare we call these Standards of Care – or – Practice Guidelines
Practice guidelines are developed by:

- An examination of evidence-based practices.
- Consensus statements from practitioners and experts within a field.
- Peer-reviewed research.
Who defines the parameters of a “Best Practice” model?

Guidelines are usually created by national or international professional associations or governmental bodies.

NOTE: Governmental bodies like the United States Agency for Healthcare Research and Quality often defer to professional associations, ex., The American Academy of Pediatrics.
Standards of Practice for Neurofeedback and Neurotherapy: A Position Paper of the International Society for Neurofeedback & Research

D. Corydon Hammond\textsuperscript{a}; Genie Bodenhamer-Davis\textsuperscript{b}; Gerald Gluck\textsuperscript{c}; Deborah Stokes\textsuperscript{d}; Sara Hunt Harper\textsuperscript{e}; David Trudeau\textsuperscript{f}; Margaret MacDonald\textsuperscript{g}; Joy Lunt\textsuperscript{h}; Lynda Kirk\textsuperscript{i}

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ASSESSMENT PROCEDURES PRIOR TO NEUROFEEDBACK TRAINING

Prior to providing neurofeedback treatment an adequate history should be obtained of medical and psychological/psychiatric problems and symptoms, the individual’s prior treatment history, and current medications the patient may be taking. The nature of the presenting problem and goals of the neurofeedback training will undoubtedly to some extent determine the type and extent of pretreatment assessment procedures. An objective assessment of the client’s EEG function should precede neurofeedback training. There are several procedures by which this may be accomplished, the most thorough being a quantitative EEG (QEEG) wherein the functioning of the brain is objectively assessed in comparison with normative data for the patient’s age, clinical and family history, and presenting symptoms.
Benefits of QEEG

To have insight into neurophysiological arousal level – not always obvious.
QEEG Tomograms
Presents as a depressed alcoholic

Although presenting as under-aroused, the QEEG gave us insight into the true neurophysiological over-arousal, when this “upstream problem” (anxiety) was properly managed this patient improved. Had he been treated for his objective depression, treatment likely would have been less effective.
Benefits of QEEG

The QEEG gives the clinician measures to more accurately determine the optimal frequency selection and sensor placement tailored to a specific patient.
Customized frequencies….

….. are derived from the 1Hz data, facilitate tailored, effective and cost-efficient neurofeedback training.

….. are especially helpful in determining inhibit frequencies and the relative weighting of each band

….. allows the training to fit the spectral like a glove rather than a mitten.
AD/HD - Theta Subtype

- Elevated Theta
- Low Beta
AD/HD Alpha Subtype

Elevated Alpha
Male age 14 Dx: ADD, ODD, Severe Sensory Integration and Memory Impairments, FAE

**Frequency Ratios**
Benefits of QEEG

Predicts response to some medications
Andrew Leuchter, MD
Professor of psychiatry at UCLA

“Selecting the right antidepressant medication is a bit of a shot in the dark.”

“The first medicine we choose only gets the patient well about a third of the time.”
### Expected Change with Dexadrine (Adderall) and Methylphenedate (Ritalin) with 3 EEG - ADD/ADHD Subtypes

<table>
<thead>
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<th>A.D.H.D. (n=65)</th>
<th></th>
<th>A.D.D. (n=47)</th>
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<tr>
<td></td>
<td>Dexadrine</td>
<td>Methylphenedate</td>
<td>Both</td>
<td>Dexadrine</td>
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<tr>
<td><strong>Theta Excess</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Change</td>
<td>6%</td>
<td>26%</td>
<td>17%</td>
<td>29%</td>
</tr>
<tr>
<td>Improved</td>
<td>76%</td>
<td>74%</td>
<td>75%</td>
<td>42%</td>
</tr>
<tr>
<td>Worse</td>
<td>18%</td>
<td>0%</td>
<td>8%</td>
<td>29%</td>
</tr>
<tr>
<td><strong>Alpha Excess</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Change</td>
<td>0%</td>
<td>8%</td>
<td>6%</td>
<td>33%</td>
</tr>
<tr>
<td>Improved</td>
<td>100%</td>
<td>92%</td>
<td>94%</td>
<td>67%</td>
</tr>
<tr>
<td>Worse</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Beta Excess</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Change</td>
<td>0%</td>
<td>33%</td>
<td>16%</td>
<td>50%</td>
</tr>
<tr>
<td>Improved</td>
<td>100%</td>
<td>67%</td>
<td>84%</td>
<td>50%</td>
</tr>
<tr>
<td>Worse</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Chabot - communicated to Bob Gurnee, MSW and shared at iSNR 8/04

*Quantitative EEG Profiles of Children with Attention and Learning Disorders and the Role of QEEG in Predicting Medication Response and Outcome*

Robert J. Chabot, Ph.D. New York University School of Medicine
Benefits of QEEG

Useful for differential diagnosis
# QEEG and AD/HD Accuracy

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity</th>
<th>Specificity</th>
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<tbody>
<tr>
<td>Quantitative EEG</td>
<td>90%</td>
<td>94%</td>
</tr>
<tr>
<td>Child Behavior Checklist</td>
<td>76%</td>
<td>69%</td>
</tr>
<tr>
<td>Devereaux Scales of Mental Disorders</td>
<td>80%</td>
<td>78%</td>
</tr>
<tr>
<td>Behavior Assessment System for Children</td>
<td>82%</td>
<td>68%</td>
</tr>
<tr>
<td>AD/HD Rating Scale</td>
<td>84%</td>
<td>49%</td>
</tr>
<tr>
<td>Early Child Inventory</td>
<td>66%</td>
<td>57%</td>
</tr>
</tbody>
</table>

**Sources:**
1. Monasta et al., 2001;  
2. Eraldi et al., 2000;  
3. Vaughn et al., 1997;  
4. DuPaul et al., 1998;  
5. Sprafkin et al., 2002;
Neuropsychiatric EEG-Based Assessment (NEBA)

First Brain-Wave Test for ADHD Approved by FDA.

... noninvasive test based on electroencephalogram technology, computes the ratio of theta and beta brain waves in 15 to 20 minutes.
Benefits of QEEG

- Helpful in forensic cases and to discern the degree of organicity.
- Treating head injury cases
- Use of discriminant analysis
Discriminant Analysis

Normal               Some known impairment
(TBI, Depression, Dementia, etc).

Your Patient
Male, 45 years old

10 years after a 8lb metal bar fell 10 feet hit the top of his head. Patient was unconscious and bled profusely.

The TBI Probability Index is the patient’s probability of membership in the mild traumatic brain injury population.

75.0% chance he had a TBI that was moderately severe

Thatcher et. al. EEG and Clin. Neurophysiol. 73, 93-106, 1989
DEWACECA  02/03/2017

Discriminant Results

Discriminant functions provide a quantitative estimate of the similarity between a patient’s profile and characteristic patterns found during extensive research on groups of patients with various disorders.

Classification by this algorithm is restricted to disorders relevant to the diagnosis or symptoms indicated in the patient history.

There was also a loss of Consciousness.

This patient’s discriminant scores suggest the presence of post-concussive syndrome (p <= 0.05)

The features making the largest contribution to the Closed Head Injury statement are:
Normed Monopolar Coherence Alpha for F3-F4,
Normed Monopolar Asymmetry Total for F3-F4,
Normed Bipolar Asymmetry Theta for Temporal
Discriminants
- NxLink or BrainDx
- Neurological Disease
- Convulsions
- Addiction (Drugs or Alcohol)
- Memory
- Confusion
- Depression
- Delusions or Thought Disorder
- Learning Disability
- AD/HD
- Bipolar
Benefits of QEEG

Expands treatment options and range of impairments you can help
Anterior Disregulations

- Mental flexibility, OCD, ODD, motivation, working memory
- Mood disorders (depression & anxiety)
- Impulse control issues, lack of motor inhibition, motor tics
- Verbal expression, distractibility
- Emotional expression, social appropriateness, aggression, mania
Posterior Cortical Impairments

- Perceptual, Sensory, and Cognitive Integration
- Spatial relations, linear logic/language (phonemic awareness), proprioception
- Selective attention, visual acuity
- Better sympathetic & parasympathetic control
- Facial recognition, decoding, visual processing
Connectivity Impairments - Learning Disorders (Neurodevelopmental Disorders - Specific Learning Disorders)

- Sensory Perception and Integration
- Speech & Language Disorders
- Dyslexia (affects 40% of the American population)
- Dysgraphia
- Math Disorder
Generalized or Specific Connectivity Impairments

- Autistic Spectrum Disorders
- Post stroke rehab
- Seizure
- Head injury rehab
- FAE
Three steps to obtain a QEEG

1. Recording the EEG
2. Analysis of the recording
3. Interpretation and integration of clinical data to develop optimal treatment plan
1) Recording

- The most mechanical part of the process.
- It is crucial it be done well to obtain reliable results.
- Demands precision and methodical application abilities, sensitivity to the patient, and the ability to work with the patient to have him/her relax and minimize EMG artifact.
- Technicians can do this when properly trained, in fact, they often become very good at obtaining high quality recordings.
- Necessitates the purchase or rental of a data acquisition instrument (Mitsar, NeuroScan, etc.) and accessories.
2) Analysis

- You can either purchase available software and databases and analyze the recording yourself.
- or -
- Upload the recording to a QEEG analysis service and have them analyze the data for you.
2) Analysis – DIY – I do not recommend this

➢ Cost and Time - requires purchasing available software and databases and learning how to use them effectively

➢ Qualifications – requires training and supervised experience to gain sufficient understanding of the EEG. The level of training required is far beyond what is necessary to be an effective neurofeedback therapist, ex., discerning artifacts, paroxysmal activity, etc.

➢ OTHER ISSUES: Convergent validity issues – you should purchase multiple databases.

➢ Obtaining a neurologist report is often difficult
Costs of DIY – Financial Costs

- $8,000 - $30,000 Data Acquisition Instrument (amplifier): Mitsar, BrainMaster, Cadwell, CapScan, DeyMed, Lexicor, NeuroScan, NeXus

- ~$13,000 for two QEEG Database analysis software packages:
  1) Neuroguide $11,000 (NeuroGuide Basic, LORETA Norms, Discriminant Functions, Connectivity Suite, LORETA Cross-Freq Coh, LORETA Source Correlation Norms),
  2) Brain Dx $2,000

- ~$3,000 For education and mentoring in learning to use the software
- $5,000-7,000 For education and supervision learning to read the EEG

TOTAL $29,000 - $53,000
Costs of DIY – Time considerations

• >20 hours – investigating and choosing a data acquisition instrument (amplifier) that fits your needs, purchasing it, setting it up.

• >35 hours - investigating and choosing two QEEG database analysis software packages that fit your needs, purchasing it, installing it.

• >145 hours - learning to effectively use most important features of the software

• ~ 720 hours (roughly an 18 week semester, 40 hours per week) learning the basics in reading the EEG

TOTAL ~ 920 hours
2) Analysis – using a QEEG service

- Person doing the analysis is an expert (or should be).
- You can order the most relevant analyses.
- The service has probably has access to databases that are no longer commercially available.
- You can compare various database results and use those that are the best fit for your patient.
- A neurologist report can usually be obtained.
- You can get their recommendations for neurofeedback and clinical correlations + treatment planning, diagnosis.
- Long run > expensive but it will always save you time.
TO FIND AN ANALYSIS SERVICE  Google: QEEG analysis services

Brain Science International
Chief Scientist: Jay Gunkelman, QEEGD

Integrated Neuroscience Services is the only company founded and operated by two Clinical Neuropsychologists: Dr. Robert Coben and Dr. Anne Stevens
92 W Sunbridge, Fayetteville, Arkansas

Behavioral Medicine Associates, Inc.
Quantitative EEG analysis with Neurofeedback, Biofeedback and Clinical Recommendations
John K. Nash, Ph.D., Licensed Psychologist

Education:
Stens Corporation
BioMedical
QEEG Report = $350

Add to Cart

QEEG Report + Neurologist visual review of the EEG traces = $420

Add to Cart

Legal cases QEEG Report = $500 (extra edits and multiple test retest reliability measures - Expert opinion)

Add to Cart
No longer do we have to guess what’s going on in the brain. We can see it happen. Live. In real time.

THE INNOVATIVE TEAM at BrainMaster produces state-of-the-art, scientific-based, leading-edge tools that modern therapists need to monitor the brain in real time, using sLORETA technology and our new BrainAvatar.

We are your source for: 1-19 Channels Neurotherapy, traditional Neurofeedback, qEEG assessment and training, Database Guidance, Live ZScore Training, ISF, Alpha/Theta, Theta/Beta, SMR, MicroTesla (pEMF), Photic, HRV, and more.

BrainMaster: Evolving the World of BIO-NEUROFEEDBACK and EEG through Innovation.

With BrainMaster EEG Biofeedback, the Possibilities are Endless.
### SNI Mapping Service

*48 hour Turn Around*

**Full Package 1 (1-7): With Report:** Minimum recommended for Neurotherapy:

<table>
<thead>
<tr>
<th>Service Description</th>
<th>Price</th>
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<td><strong>NX Link – NYU/E. Roy John Normative Database-Eyes Closed</strong></td>
<td>$80.00</td>
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<td>A. NX Link Discriminant Analyses: ADD, LD, Depression / Bipolar, Memory / Dementia</td>
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</tr>
<tr>
<td>Subtypes, Substance Abuse, Head Injury, Schizophrenia</td>
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<tr>
<td><strong>Neuroguide - R. Thatcher Normative Database</strong></td>
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<tr>
<td>A. Eyes Closed Linked Ears Z-scores</td>
<td>$80.00</td>
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<tr>
<td>B. Eyes Closed Laplacian Z-scores</td>
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<tr>
<td><strong>EureKa3! – EEG Relative Current Source Density LORETA Adult Normative Database</strong></td>
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<tr>
<td>A. Eyes Closed - Weighted Average, Z-scores, Magnitude, % Power, Laplacian, Average Spectrum, coherence, connectivity</td>
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<td>B. Eyes Open - Weighted Average, Z-scores, Magnitude, % Power, Laplacian, Average Spectrum, coherence, connectivity</td>
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<tr>
<td><strong>Neuroguide TBI Discriminant Analysis and Severity Index</strong></td>
<td>$80.00</td>
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<tr>
<td><strong>Neuroguide Network Injury Index: Surface QEEG Z-Scores &amp; LORETA Network Z-Scores</strong></td>
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<tr>
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</tr>
</tbody>
</table>

**Total Value:** $800.00

**Additional Services**

<table>
<thead>
<tr>
<th>Service Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Conventional Medical EEG (Neurologist Review) when purchased with package #1 or 2</td>
<td>$130.00</td>
</tr>
<tr>
<td>9. EureKa3! – Nova Tech EEG LORETA Analysis - Eyes Open-Non Database</td>
<td>$80.00</td>
</tr>
<tr>
<td>10. Task Without Package Purchase: Neurorep - W. Hudspeth QEEG Analysis System:</td>
<td>$75.00</td>
</tr>
<tr>
<td>Weighted Average, Z-scores, Magnitude, % Power, Laplacian, Average Spectrum</td>
<td></td>
</tr>
<tr>
<td>11. Task with Package Purchase</td>
<td>$50.00</td>
</tr>
<tr>
<td>12. Supervision and Training Hourly Rate (Consults with SNI Providers, etc.)</td>
<td>$125.00</td>
</tr>
</tbody>
</table>

**Note:** If only one database choice is made (e.g. Neuroguide Eyes Open) the minimum price for processing is $90.00.

**Note:** Package #1 and #2 includes either one PDF copy (sent via FTP upload) or one paper copy of maps (sent via priority mail). To receive both electronic (PDF) and paper copies of the maps there is an additional charge of $15.00 (see #14).
Not to be confused with a typical QEEG report
Less cost and clinicians can probably access this with the instrument you are currently using
3) Interpretation and integration of clinical data to develop optimal treatment plan

- The treating clinician is ultimately responsible for the implementation of a “best practice” treatment plan.
- He or she is the only person who has all the information necessary to accomplish this.
- Initially, clinicians should work with a mentor or supervisor and would likely rely more on the recommendations of the analysis service.
- As the clinician gains experience, the clinician becomes better at utilizing the information contained in a QEEG as a helpful source of information that, when integrated with other assessment data, helps to derive an efficacious treatment plan.
Steps toward proficiency using the QEEG

• Investigate the cost and time involved in this project
• Decide on your path: DIY or employ an analysis service
• Work up a budget: cost and time
• Connect with and obtain a commitment from a mentor or supervisor
• Discern if there is a defined curriculum to demonstrate proficiency
  • If so, consider following it and sign up to attend recommended classes.
• Obtain any suggested reading lists or media materials and purchase them
The end....

Gary Schummer

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Thank You!