qEEG & Neurofeedback
Brain Training

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Course Outline

Handouts!
- Definition of NFB
- Introduction to qEEG guided Neurofeedback
- Explanation of qEEG evaluation/Measures
- Explanation of the Neurofeedback Intervention or Brain Training TX
- The business end of qEEG NFB
Neurofeedback Defined

- Like other forms of biofeedback, NFT uses monitoring devices to provide moment-to-moment information to an individual on the state of their physiological functioning.
- The characteristic that distinguishes NFT from other biofeedback is a focus on the Central Nervous System.
- NFT has its foundations in basic and applied neuroscience as well as data-based clinical practice.
- It takes into account behavioral, cognitive and subjective aspects as well as brain activity (ISNR, 2014).
- It works on Operant Conditioning.

Neurofeedback is considered an integrative approach and works well with other modalities; it provides more complete TX.

- Group therapy
- Individual Therapy
- Family Reconstruction
- Psychiatry/Medication
- Psychology/testing and roll out of talk therapy
- Hypnosis
- EMDR
- Exposure
- Breath/Body work/DBT
- 12-Step


A step-wise explanation of qEEG-guided neurofeedback

- Orientation/SCL
- Acquire EEG, convert into qEEG; set up SCL
- Set up file Structure; add Excel capacity
- Brain Mapping Surface Z scores; LORETA & 3-D
- Develop Protocols (guided by symptoms and metrics for a custom TX. in a hybrid format)
- Report Creation sent to therapists to mull over
- Select issues to be addressed working w/ primary DX., first
- First 10 sessions of NFB Brain Training
- Brain Mapping again to indicate progress and changes
- Second 10 sessions of NFB Brain Training for another symptom using custom protocol

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### Current Problems or Symptoms

<table>
<thead>
<tr>
<th>Current Problems or Symptoms</th>
<th>SEVERITY (1 to 10)</th>
<th>Age Started If severity &gt;3</th>
<th>Optional Comment Use back if necessary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denial of a problem</td>
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<td>Attention Deficits- Easily distractible, etc</td>
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<td>Auditory sequencing (listening &amp; putting things in correct order)</td>
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<td>Balance Problems</td>
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<td>Blurred Vision</td>
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<td>Chronic Pain</td>
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<td>Compulsive behaviors and/or thoughts</td>
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<td>Decreased tactile (touch) or skin sensitivity</td>
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<td>Delusional (distorted or fixed idea(s))</td>
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<td>Depression (sad or blue)</td>
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<td>Difficulty understanding social cues</td>
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<td>Difficulty calculating e.g., math</td>
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<td>Dyslexia- letter reversal</td>
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<td>Executive Function problems (judgment, decision making, self monitoring, organizing, etc.)</td>
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<td>Face Recognition Problems</td>
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<td>Failure to initiate action</td>
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<td>Generalized Anxiety</td>
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<tr>
<td>Hyperactive and/or agitation</td>
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<tr>
<td>Impulsive Behaviors</td>
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</table>
What is a qEEG?

- A qEEG (quantitative Electroencephalography) is a computer generated analysis of EEG data, providing information about cortical timing.

- The analysis provided identifies variations from the norm/average as compared to a normative database.

qEEG Measures

Fig. 1 – Example of conventional digital EEG (left) and qEEG (right) on the same screen at the same time. The conventional EEG includes examination and marking of EEG traces and events. The qEEG (right) includes the Fast Fourier Transform (Top right) and normative database Z scores (Bottom right).
Brain Mapping Measures Used


<table>
<thead>
<tr>
<th>Brodmann Areas</th>
<th>Location</th>
<th>Functions</th>
<th>Right Hemisphere</th>
<th>Left Hemisphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Supramarginal Gyrus/</td>
<td>Economic decisions, (bilateral) goals, pain, conscious awareness of visual spatial events (bilateral), activation at rest- default mode network (bilateral)</td>
<td>Personal space, estimate, meta-emotions, mental rotation, stereopsis, Line bisection judgments, Visuospatial attention Retrieval of words</td>
<td>Recall episodes, tool use, handwriting, spelling, shift attention, language, literalness, imageability</td>
</tr>
</tbody>
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### NFB Treatment[^10]

- **Operant Conditioning**
- **The Mechanism of rewards lies within each individual and is different for everyone**

#### Biological Correlates of Operant conditioning: The highlight neurochemicals

- Acetylcholine
- Norepinephrine
- Dopamine
- Serotonin

How does it work, again?

- Looney Tunes

Simply put, Neurofeedback,

Exercises your brain!

And addresses resistance
How long is a typical session?

Seamless QEEG and Neurofeedback – approx. 50 - 60 minutes for a single Session in four Steps from Clinical Interview to QEEG to Neurotherapy

1. Interview: 10 min
   - Symptom Check List

2. Record EEG: 30 min
   - Edit & Symptom Check List Match

3. Neuro-Feedback: 20 min

Clinician


Reward Network

prefrontal cortex

nucleus accumbens

VTA


Neuroplasticity

- Refers to the brain’s ability to change
- The brain’s plasticity is strongest during childhood
- Neuroplasticity impacts our ability to learn and change behaviors
- qEEG-guided NFB changes neuroplasticity
<table>
<thead>
<tr>
<th>Neurotransmitter</th>
<th>Distribution in the Central Nervous System</th>
<th>Functions Affected</th>
<th>Drugs That Affect It</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dopamine</td>
<td>Midbrain, Ventral tegmental area (VTA), Cerebral cortex, Hypothalamus</td>
<td>Pleasure and reward, Movement, Attention, Memory</td>
<td>Cocaine, Methamphetamine, Amphetamine. In addition, virtually all drugs of abuse directly or indirectly augment dopamine in the reward pathway</td>
</tr>
<tr>
<td>Serotonin</td>
<td>Midbrain, VTA, Cerebral cortex, Hypothalamus</td>
<td>Mood, Sleep, Sexual desire, Appetite</td>
<td>MDMA (ecstasy), LSD, Cocaine</td>
</tr>
<tr>
<td>Norepinephrine</td>
<td>Midbrain, VTA, Cerebral cortex, Hypothalamus</td>
<td>Sensory processing, Movement, Sleep, Mood, Memory, Anxiety</td>
<td>Cocaine, Methamphetamine, Amphetamine</td>
</tr>
<tr>
<td>Endogenous opioids (endorphin and enkephalin)</td>
<td>Widely distributed in brain but regions vary in type of receptors, Spinal cord</td>
<td>Analgesia, Sedation, Rate of bodily functions, Mood</td>
<td>Heroin, Morphine, Prescription painkillers (Oxycodone)</td>
</tr>
<tr>
<td>Acetylcholine</td>
<td>Hippocampus, Cerebral cortex, Thalamus, Basal ganglia, Cerebellum</td>
<td>Memory, Arousal, Attention, Mood</td>
<td>Nicotine</td>
</tr>
<tr>
<td>Endogenous cannabinoids (anandamide)</td>
<td>Cerebral cortex, Hippocampus, Thalamus, Basal ganglia</td>
<td>Movement, Cognition and memory</td>
<td>Marijuana</td>
</tr>
<tr>
<td>Glutamate</td>
<td>Widely distributed in brain</td>
<td>Neuron activity (increased rate), Learning, Cognition, Memory</td>
<td>Ketamine, Phencyclidine, Alcohol</td>
</tr>
<tr>
<td>Gamma-aminobutyric acid (GABA)</td>
<td>Widely distributed in brain</td>
<td>Neuron activity (slowed rate), Anxiety, Memory, Anesthesia</td>
<td>Sedatives, Tranquilizers, Alcohol</td>
</tr>
</tbody>
</table>
Efficacy of qEEG NFB for SUDs

Visible, Proven Success

Ample data exists to illustrate neurofeedback’s success in helping patients complete treatment programs for drugs and alcohol, including one notable 2005 study from the American Journal of Drug and Alcohol Abuse in which neurofeedback patients were compared to those simply receiving extra therapist time.

The results revealed that neurofeedback patients:

- Increased their rate of program completion by 41%
- Improved their ability to sustain attention and inhibit impulsive behaviors
- Decreased their rates of anxiety and depression
- Increased by 75% their rate of sustained recovery during the 12 months of follow-up (see graph)

Percent of Clients with Sustained Recovery for 12 Months

How Important is combining qEEG with neurofeedback?

- A qEEG report provides information that can help a professional target neurofeedback training.

- Combining the qEEG and analyzing the EEG can display information about a person’s brain problem and can speed the efficacy of neurofeedback training.

Robert W. Thatcher, Ph.D. “Neuropsychiatry and Quantitative Electroencephalography (qEEG) in the 21st Century” Neuropsychiatry (2011)
Can a clinician use a qEEG without specific training or experience?

- There is a big learning curve when learning to apply information from a qEEG.
- Some decide to learn the qEEG and neurofeedback at once or to rely on experts who can provide an analysis of the qEEG and how to combine it with neurofeedback.

Do I need to buy special qEEG equipment?

- Yes- one can buy special equipment or one can send a client to a location that can record the EEG for you, although not all equipment is compatible with neurofeedback-oriented qEEG’s.
- CR has the equipment in-house.
- It is called a NeuroField amplifier and we use NeuroGuide as our statistical program. Both are FDA registered!
Can a clinician attempt to learn neurofeedback training and qEEG at the same time?

- One can do this, but the learning curve for both concepts is very steep, so it is recommended that a clinician learn the basics of neurofeedback first, followed by learning the qEEG.

Is there insurance reimbursement?

- There are two main billing codes: 95816 for the EEG and 95957 for the analysis of the EEG. Professional interpretations are billed with the same codes but with the trailer “-26.”
Do qEEG’s improve client compliance?

- According to several clinicians, the qEEG adds credibility and has improved client motivation to stick with the neurofeedback program.
- Neurofeedback training enhances patient’s longevity in most intervention modalities particularly with our pt. population as was documented in a RCT performed in 2005 at UCLA with a primary SUD sample of approx. 200 pts (Scott, 2005)

Who should qEEG NFB be recommended to?

This should be based on judgment, but some recommendations of situations to be considered are:

- SUDs
- TBI/Stroke/Head injury
- Rage disorders
- Depression
- Anxiety
- Seizures
- Long, difficult psychiatric/medical history with little response to many medications
- Suicidal depression
- Existing neurofeedback client who is making little or no progress within 8-15 sessions

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References

- Cannon, R., Lubar, J., Sokhadze, E. and Baldwin, D.

References

References