Exploring Neurofeedback

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TBI Forum

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Objectives

• Provide a general definition and experience of biofeedback
• List the potential risks and benefits of neurofeedback
• Highlight the current evidence regarding neurofeedback use after TBI
Take Home Points

• Biofeedback is generally low risk
• Certification is available for biofeedback practitioners
• Finding someone who is certified in qEEG is likely important for neurofeedback
• Notice and discuss any side effects
• Evidence about neurofeedback is largely at the case series / case report level
You & Your Nervous System
Mind & Body Exercises

Don’t think about a polar bear

Think about eating a lemon
Mind & Body Exercises

Control your breathing so you count 4 on the inhale and count to 5 on the exhale
Mind & Body Exercises

Find a tight muscle in your body, tighten it up and then let it relax. Do this 5 times.
Learning to Influence Mind-Body Connections
• When you are nervous are your hands:
  – Warm or cold?
  – Sweaty or dry?
• When you are nervous are your hands:
  – Warm or cold?
  – Sweaty or dry?

Perhaps if you could train yourself to have warmer dry hands then that could help you control feelings of nervousness.
What is Biofeedback?

- The therapy technique of providing the status of one’s own autonomic nervous system function (e.g. skin temperature, heartbeats, brain waves) as visual or auditory feedback in order to self-control related conditions (e.g. hypertension, migraine headaches)
Autonomic Nervous System (ANS)

• Functions
  – Sympathetic $\rightarrow$ *Fight or Flight*
  – Parasympathetic $\rightarrow$ *Rest and Digest*
  – (Enteric nervous system)
Examples: Autonomic Influence

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Sympathetic System</th>
<th>Parasympathetic System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iris of the eye</td>
<td>Pupil Dilation</td>
<td>Pupil constriction</td>
</tr>
<tr>
<td>Salivary glands</td>
<td>Less Saliva Production</td>
<td>More Saliva Production</td>
</tr>
<tr>
<td>Heart</td>
<td>Increase Heart Rate</td>
<td>Decreased Heart Rate</td>
</tr>
<tr>
<td>Stomach and intestines</td>
<td>Decreased activity</td>
<td>Increased activity</td>
</tr>
<tr>
<td>Bladder</td>
<td>Relaxes the bladder muscle</td>
<td>Helps contract the bladder muscle</td>
</tr>
<tr>
<td>? Brain Waves ?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example of Biofeedback Setup

www.mindmodulations.com
What is Neurofeedback?

• A technique to self-regulate brain activities provided as a feedback in order to better control or enhance one’s own performance, control or function. This is done by trying to bring brain activities into a range associated with a desired brain function or status.

2011 MeSH Descriptor Data
Brain Waves – Electroencephalogram (EEG)
Brain Waves

<table>
<thead>
<tr>
<th>DELTA</th>
<th>THETA 4–8 cps</th>
<th>ALPHA 8–12 cps</th>
<th>SMR 12–15 cps</th>
<th>BETA 15–18 cps</th>
<th>HIGH BETA more than 19 cps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep</td>
<td>Drowsy</td>
<td>Relaxed Focus</td>
<td>Relaxed Thought</td>
<td>Active Thinking</td>
<td>Excited</td>
</tr>
</tbody>
</table>

Figure 7-1. The Range of Brainwaves in the Human Brain

cps = cycles per second, or Hertz

www.drross.org
qEEG (Brain Mapping)
General Steps in Neurofeedback

• Baseline Electroencephalogram (EEG)
  – Quantitative EEG, qEEG, brain mapping, BEAM (brain electrical activity mapping)

• Training Sessions, focused on an area
  – Often 15 – 50 training sessions; some advocate for 100+ training sessions

• Repeat qEEG

• Maintenance plan
Example of Neurofeedback Setup
Summary Points: Evidence

• Significant variety in EEG patterns even within one diagnostic category
• Most evidence for neurofeedback effects after TBI are at the case series / case study level
• Unclear if we can generalize treatment of diagnoses with similar symptoms and TBI symptoms the same way (e.g. ADHD, insomnia, depression, headaches)
• Neurofeedback is likely relatively low risk
Studies: Neurofeedback and TBI
Current Studies

Therapeutic Effects of Neurofeedback in Anorexia Nervosa Condition: Neurofeedback Intervention: Behavioral: neurofeedback training 2 Unknown † Project Attention Deficit Hyperactivity Disorder (ADHD) and Electroencephalography (EEG)-Neurofeedback THERapy Condition: ADHD Interventions: Other: Placebo EEG Neurofeedback; Other: EEG-Neurofeedback 3 Not yet recruiting


Levels of Evidence

- No RCTs of neurofeedback after TBI
- Some exploratory studies or RCT pilots, especially in neurofeedback for ADHD
- Case Series, Case Reports, Expert Opinion
Potential Risks

• Non-invasive
• Good rapport with trainer is important
• Symptoms that are being targeted may worsen sometimes with therapy or with different types of therapy
• Generally mild side effects reported:
  – Fatigue, anxiety, headache, sleep changes, irritable, vocal tics, regression, muscle twitches, GI symptoms, slurred speech...
Potential Benefits

Neurofeedback has resulted in improvement of _______________ for someone.
Summary Points: Evidence

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Discussion

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206-744-4179
Resources - 1

• 2011 MeSH Descriptor Data; National Library of Medicine;  
  www.nlm.nih.gov/mesh/Mbrowser.html

• www.clinicaltrials.gov

• Biofeedback certification International Alliance (BCIA)

• D. Corydon Hammond, Ph.D. Physical Medicine and Rehabilitation, University of Utah
Resources - 2

- EEG & Clinical Neuroscience Society  
  www.ecnsweb.com
- Quantitative Electroencephalography Certification Board  
  www.qeegboard.org
- International Society of Neurofeedback and Research
Resources - 3