UNIVERSITY of WASHINGTON

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)

2011 MeSH Descriptor Data

Autonomic Nervous System (ANS)

- Functions
  - Sympathetic → *Fight or Flight*
  - Parasympathetic → *Rest and Digest*
  - (Enteric nervous system)

Examples: Autonomic Influence

Body Part	Sympathetic System	Parasympathetic System
Iris of the eye	Pupil Dilation	Pupil constriction
Salivary glands	Less Saliva Production	More Saliva Production
Heart	Increase Heart Rate	Decreased Heart Rate
Stomach and intestines	Decreased activity	Increased activity
Bladder	Relaxes the bladder muscle	Helps contract the bladder muscle
? Brain Waves ?		

Example of Biofeedback Setup

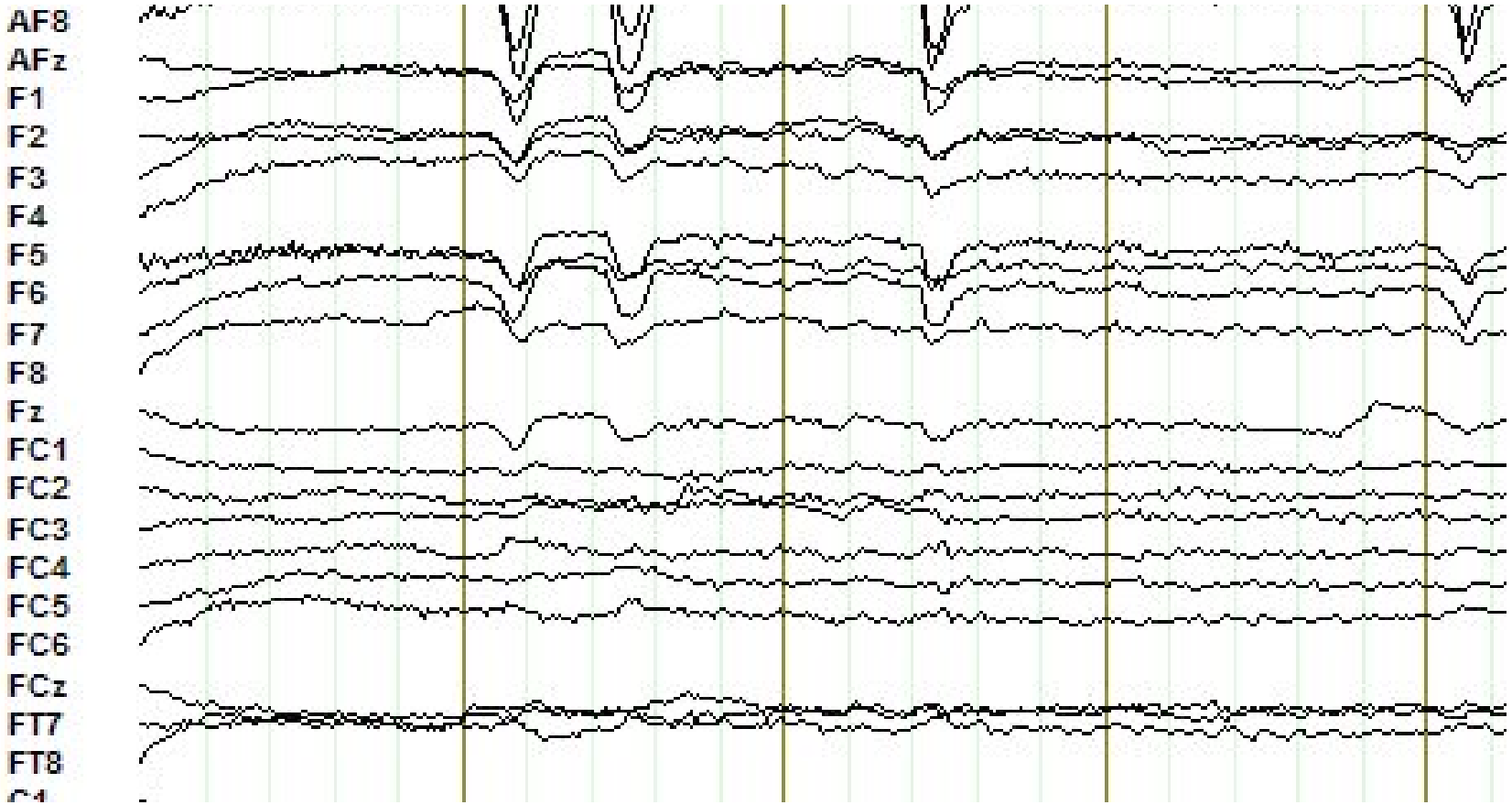
www.mindmodulations.com

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

cps = cycles per second, or Hertz

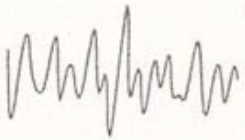
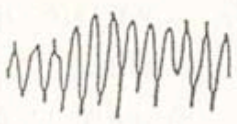
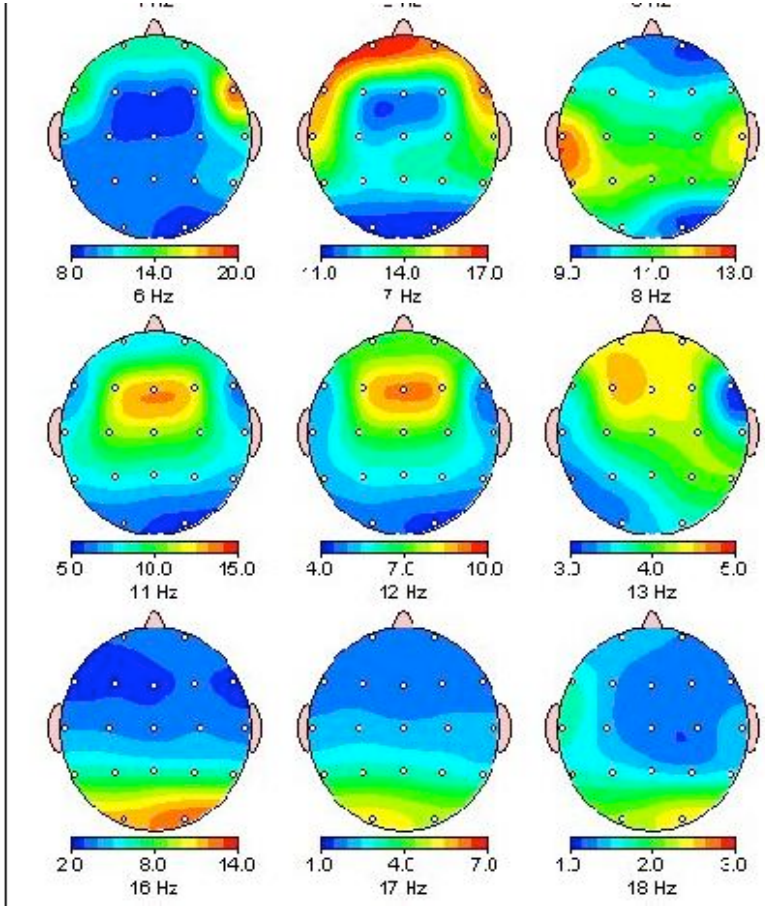
DELTA Less than 4 cps	THETA 4–8 cps	ALPHA 8–12 cps	SMR 12–15 cps	BETA 15–18 cps	HIGH BETA more than 19 cps
Sleep	Drowsy	Relaxed Focus	Relaxed Thought	Active Thinking	Excited
					

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

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

Collaborative Study Of Neurofeedback Training Of 6-18 Year Olds With Autism Condition: Autism Intervention: Behavioral: Neurofeedback training 4 Recruiting Neurofeedback Treatment of Pain in Persons With Spinal Cord Injury (SCI) Conditions: Spinal Cord Injuries; Pain Intervention: Behavioral: Neurofeedback 5 Recruiting Train Your Brain and Exercise Your Heart? Advancing the Treatment for Attention Deficit Hyperactivity Disorder (ADHD) Condition: Attention Deficit Hyperactivity Disorder (ADHD) Interventions: Other: Neurofeedback; Behavioral: Exercise; Drug: methylphenidate 6 Unknown † Pediatric Research on Improving Speed, Memory and Attention Condition: Brain Tumors Interventions: Other: Neurofeedback; Other: Placebo feedback 7 Recruiting Neurofeedback and Pain Conditions: Pain; Peripheral Neuropathy Interventions: Behavioral: EEG biofeedback (BF) Group; Behavioral: Wait-List Control (WLC) Group; Behavioral: Follow UP Questionnaires 8 Recruiting Investigation of Neurofeedback With Real-Time fMRI in Healthy Volunteers and Patients With Hyperkinetic Movement Disorders Conditions: Movement Disorder; Tourette Syndrome; Healthy Volunteer Intervention: 9 Recruiting

Chronic Pain and Brain Activity in Spinal Cord Injury Condition: Spinal Cord Injury Interventions: Other: Hypnosis; Other: Meditation; Other: Neurofeedback training; Neurofeedback Treatment of Pain in Persons With Spinal Cord Injury (SCI) Conditions: Spinal Cord Injury; Pain Intervention: 11 Recruiting

Intellectual Impairment in Women With Breast Cancer Condition: Breast Cancer Interventions: Behavioral: Cognitive Rehabilitation; Behavioral: Neurofeedback Training (randomized)

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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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
- Hammond, et al. Position paper: Standards of practice for neurofeedback and neurotherapy: A position paper of the International Society for Neurofeedback and Research. J of Neurotherapy, 15:54-64.

Resources - 3

- Hammond, et al. First, do no harm: Adverse effects and the need for practice standards in neurofeedback. J of Neurotherapy. 2008, 12(1): 79-88.