Neurotherapy: An Emerging Treatment for Traumatic Brain Injury and Veterans with Blast Injuries

NABIS
New Orleans, 2013
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Outline

• Brief history of biofeedback technology
• Neurofeedback research for TBI (NIH study)
• Neurofeedback research for OEF/OIF veterans with TBI & PTSD
• Video of veteran with GSW to left temporal lobe.
• Video patient 5 years post-stroke regained control of leg with NFB & sEMG biofeedback
• NFB potential “Value added” for integration into rehabilitation facilities.
Clinical biofeedback research in US began at the Voluntary Controls Lab, Menninger Clinic, Topeka, Kansas in 1960s
Now Available For Apple and Droid Phones
Heart Rate Variability:

Comprehensive Physiological Biofeedback

Cleveland Clinic & HRV: Patients waiting for heart transplants were removed from list.

Older HRV biofeedback technology was used in combination with NFB for Vietnam Veterans VA addiction/PTSD study. (*Medical Psychotherapy* 1991)
Biofeedback for the Brain
Neurofeedback (NFB) - 2 Types

1 - Operant Conditioning - Active process, with conscious learning

2 – Passive - Brain changes unconsciously in response to miniscule electromagnetic feedback.
Flexyx Neurotherapy System (FNS)
A Passive Neurofeedback System
Thanks to all those who participate in the world of TBI research.

A special thank you to our military service members who willingly put themselves in harms way.
FNS History

NIH-Funded Research for Mild/Moderate TBI:
With Kessler Rehabilitation Institute, West Orange, NJ

Flexyx Neurotherapy System in the Treatment of Traumatic Brain Injury:
An Initial Evaluation.
Schoenberger, et. al. 2001. *Journal of Head Trauma Rehabilitation*. Vol. 16 (3) 260-274
N=12
TBI: Mild/Moderate
3 – 21 Years pre-treatment
LOC: Brief - 27 days.
Wait-List Controlled
Subjects Chosen by Kessler Neuropsychologist
No Further Improvement Expected
All Rehab Programs Completed

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Treatment: 25 ½ hour sessions over 6-10 weeks

After treatment: “. . .seven (subjects) were able to work professionally or engage in full academic work.”
Symptom Changes in one subject – 21 Years after moderate TBI: All normal since treatment ended in 1997

Vision: Quadrantiopia resolved in 13 sessions

Dysautonomia: Body temp (cold for 21 years)

Speech: Fluent

Fatigue: Gone
Would neurofeedback be beneficial for combat-related TBI/PTSD?

Blast waves produce complicated effects as they pass through the body.
Organs and tissues of different densities are accelerated at different rates:

Blast injury affects air-fluid interfaces,
- lungs,
- bowel,
- middle ear.

Rupture of the eardrum is the most frequent injury.
Cardiovascular Effects of Blasts

“...rapid increase in cerebrovascular pressure may cause damage to both very small cerebral blood vessels and the BBB in the brain . . . Therefore, psychiatric disorders . . . may potentially also be a result of secondary neuronal damage caused by volumetric blood surge in the brain.”

p. 105

Skull Flexure from Blast Wave: A Mechanism for Brain Injury with Implications for Helmet Design

“...direct action of the blast wave on the head causes skull flexure, producing mechanical forces in brain tissue comparable to those in an injury-inducing impact, even at non-lethal blast pressures...”

This article has been authored by Lawrence Livermore National Security, LLC (“LLNS”) under Contract No. DE-AC52-07NA27344 with the U.S. Department of Energy. William C. Moss, & Michael J. King. LLNL, Livermore, CA. Eric G. Blackman, Dept. of Physics, Univ. of Rochester.
Treatment Protocol
25 brief treatments

All 8 received exactly the same Neurofeedback treatment.
Study started in 2007
Veterans Like:

Never Need to Talk About Traumatic Events
## Prescription Medication Reduction During Treatment

<table>
<thead>
<tr>
<th># 1-01</th>
<th>Prescription Drugs at Start of Study</th>
<th>Prescriptions Reduced or Eliminated by WRAMC Physicians During Study</th>
<th>Physician – Prescribed Drugs Remaining at End of Study</th>
</tr>
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</table>
|        | May 18, 2007  
Zoloft 100 mg x 2  
Ambien 10 mg  
Tramadol 150 x 3  
Phenergan 25mg x 6  
Percocet PRN  
Lithium  
Requip 25 mg x 2 | Tramadol  
Phenergan 6/1/2007  
6/18/2007: reduced dosage  
Zoloft  
Percocet  
Ambien  
Lithium | At 6-month follow-up 1/2008  
only taking  
Lithium and Zoloft |
| #1-02 | None reported | None | None |
| #1-03 | Depakote  
“Alcohol supplement” | Depakote | Reported less alcohol use. |
| #1-04 | Nortriptyline  
Vistaril | Nortriptyline  
Vistaril | None |
| #1-05 | Celexa 40 mg.  
Effexor  
Neurontin | Effexor  
Neurontin | Celexa (reduced to 20 mg. |
| #1-06 | Trazadone  
Abilify  
Zoloft  
Klonopin  
Ambien | Trazadone  
Abilify  
Klonopin | Zoloft  
Ambien |
| 1-09 | Celexa 40 mg  
Serequel 700 mg  
Prazacine 5 mg | None | None |
| 1-11 | None. Nothing had worked before and all interfered with cognitive functioning so he stopped all meds before the study. | None | None |
Personal Choice of Most Problematic Symptoms
Average Ratings
(0=no problem; 10=severe problem)
First OEF/OIF Soldier In Study
Major Presenting Symptoms

Severe short- & long-term memory
Anger
Headache
PTSD

Survived: 9 IED events, 3 LOC: >30 minutes
Pre-treatment Map

Current Medications:
- Zoloft
- Lithium
- Trazodone
- Phenergan (every 6 hours HA)
- Tramadol (x3)

After 12 Treatments:
Off pain meds

1-01

Current Medication:
- Zoloft
- Lithium
EFFECTS of TBI on FAMILY LIFE
Recovery of
MEMORY, COGNITION, and
EMOTIONAL CONTROL

CHILDREN
SPOUSE
Reactivity Is Usually Reduced Within 12 - 13 Treatments

Service members began to talk about traumatic experiences.

Nightmares → Dreams

Flashbacks → Memories

Explosiveness → Irritability → Normalizes

Suicidal State → No longer present (Open discussion)
Description of Flexyx Neurotherapy System

- An electromagnetic signal of same power as EEG is sent to scalp at speed controlled by client’s own EEG.

- Dr. Ayub Ommaya, (Dr. Gennarelli’s colleague in DAI research) thought that it is stimulating change in neurotransmitter function, & re-establishing neural connections.

- “If it were stronger it probably wouldn’t work.”

- Rare: Adverse side effects. Headache, sleepiness, temporary recall of old physical pain sensation
Response during first FNS treatment

- Note reduction in EEG tracing.
- Brain's response was smoothness of firing
- Usually followed by some symptom change

Dr. Masel yesterday: *tDCS reduces cortical excitability*

This may be a picture of that response
Some OEF/OIF Individual Outcomes

• 1-04: Hospitalized for TBI/PTSD/Suicidal. Graduated college. Now doing MRIs in a neuro-research lab preparing for Ph.D. in neuroscience.

• 1-06: TBI/PTSD/Attempted Suicide. Referred by other vets. Graduated with RN. Now entering Nurse Practitioner program.

New TBI Study for OEF/OIF Veterans

Traumatic Injury Research Program, Dept of Military and Emergency Medicine at USUHS in collaboration with Brain Wellness and Biofeedback Center in Bethesda.

Contact me or Dr. David Keyser: david.keyser@usuhs.mil
# History of Captain Horan’s Injury & Treatments

- **Craniotomy and Temporal Lobectomy.**
- **Expressive aphasia**
- **No peripheral vision.**
- **Deaf in left ear.**
- **Blindness in right half of visual fields**
- **Reading - minimal**
- **Partial Complex Seizures**
- **Anosmia**
- **Right hemiparesis,**

**WRAMC**

**RIC**

**Casa Colina, CA.  Speech and OT**
(Francine Aron- Case manager)

**University of Michigan Aphasia Program**

**Intensive Arm Therapy - U. Alabama**

**DVBIC, Charlottesville, VA. - OT, SLP. Neurofeedback**

Referred for Neurofeedback by Kate Bennet at DVBIC.

Treatment began in November, 2012
NFB Treatments at DVBIC

DVBIC Charlottesville, VA

OT
Speech
Neurofeedback with Gary Levine, SLP

35 Z-Score treatments.
15 LENS treatments (Successor to FNS)

Discharge report: “Difficulty with word finding. Better at finding words.”
VIDEO
Captain Horan
Changes during Captain Horan’s NFB treatment.
20 Treatments Nov. 11, 2012 – May 23, 2013

Sessions 1 – 4  Nov. 11 - 26/2012
Began using phone organizer.
Made complicated restaurant reservations. (Several calls)
Tried cooking by himself.

Sessions 5 – 10  Nov. 30 – Dec. 20/2012
Organizing schedule / transportation in advance
Made Christmas card on computer
Helping with laundry and dishes
No daytime naps needed

Sense of smell returning
Merry Christmas

The Horan Family
Pat, Patty and Wilson
Sessions 11 – 20    Ended May 23/2013

Motivation & Initiation:
Organized a conference call
Finishing what he starts
Doing own appointments
Energy - excellent
Able to speak fluently longer before tiring.
Psychiatrist Referred Stroke Patient for NFB

2005 - several infarcts - vertebral, middle cerebral and internal carotid arteries
Paralysis - left arm; brace on left leg. Walked with assistance and cane - swinging leg from hip.
Left neglect in the visual field, working memory problems, severe depression (daily crying spells), and fatigue.
Completed: PT
Concurrent therapies: OT, Massage, Acupuncture.
NFB began in 2009 – 26 treatments in 6 months: Visual neglect greatly reduced Depression gone Reading novels with good memory Making CDs of favorite music for others

After 9 sEMG (Muscle Biofeedback) Treatments Able to control leg for first time in 5 years Improved enough to re-qualify for PT

Video
Consider NFB as a potential resource for outcome data. Dr. Gary Ulicny described the necessity for outcomes to prove rehabilitation value.

Synergy shows in treatment outcomes when there is interdisciplinary collaboration with NFB.

We coordinate our treatments with PTs, SLPs, and OTs in private and hospital rehab programs.
Some Sources for Equipment

• Biomedical Instruments: http://bio-medical.com

• www.thoughttechnology.com  1-800-361-3651

• jjengineering.com

• For NFB Equipment Most Similar to FNS:
  Neuro-Gen High-Performance Neurofeedback
  Mind-BrainTraining.com
Finding Providers & Training

BCIA.org
(Look for Certified Providers)

AAPB.org

ISNR.org
THANK YOU!

QUESTIONS?

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info@bainwellnessandbiofeedback.com
Gun shot wound - left side of face

- Occasionally verbally abusive
- Aphasia
- Paranoia
- Complex partial seizures (partially controlled)
- Bullet fragments in brain

May 1999
- Wellbutrin 150 mg. Bid
- Neurontin 1200 mg.
- Klonopin 1 mg
- Tegretol 300 mg qid
- Xanax 0.25 mg. bid
- Lamictal 225 mg bid
- Celexa 20 mg qid
- Navane 2 mg bid

Feb. 2002
- Celexa 40 mg bid
- Klonopin 40 bid
- Neurontin 400 mg / 800 qhs.
April 2001: Stopped Neurontin for 12 hours and began having seizures.

February 2002: Without Neurontin 5 days -- No seizures, but felt emotionally unstable.
Two TBI With LOC Pre-Vietnam (twice: 1st: 3+ hours, 2nd: ~ ½ hour)

Aircraft ejection, tree landing, falling 150 feet to ground - many broken bones

Taken prisoner 1968 – 69 countless beatings; Beriberi

Starting Medications (2-5-08):
  - Cardiac
  - Naprosyn 1,000 mg, day
  - Tylenol daily

Ending Medications (4-2-08):
  - Cardiac
  - Tylenol 1 –2Xs/week

25 total NFB treatments
Vietnam Veteran Data
Neurotherapy Center of Washington Pilot Study Results:
Neurofeedback Therapy to Treat Traumatic Brain Injury and
Post Traumatic Stress Disorder
Mary Lee Eady, LGSW-C, PhD,
Neurotherapy Center of Washington, Bethesda, MD ph: 301-462-7176
April, 2008

V-1-01: Vietnam Veteran, 68 yr old male. POW - 6+ years
Personal Choice of Most Difficult Problems of Daily Life
(1=no problem; 10=severe problem)

V-1-01: Beck Depression Inventory - Total Score

V-1-01: Brief Pain Inventory - Overall Pain

V-1-01 POW 5+ YEARS
Two TBI with LOC Pre-Vietnam (1st: 3+ hours; 2nd: ~1/2 hour)
Aircraft ejection, tree landing, falling 150 feet to ground - many broken bones
Taken prisoner 1965 - 68, many beatings; Beriberi
Starting Medications (2-5-68) Cardiac
Naprosyn 1,000 mg/day Tylenol 1-2 times/week
Current Medication (4-2-06) Cardiac
Tylenol 1-2 times/week
Vietnam Veterans Addiction Research
• Failed at least 4 in-patient programs
• 20+ years of addiction history.

Menninger Addiction Treatment Protocol
Combined Neurofeedback and Thermal Biofeedback
Peniston, E.G., Kulkosky, P.J.


**Figure 1.**
Mean (+SD) MMPI T-scores of the traditional medical control group (TC) on three validity scales and ten clinical scales, before (PRE) and after (POST) treatment.
MMPI: Neurofeedback Treatment Group

NFB Group: Intervention:
8 – ½ hour Thermal BFB sessions
(Train hand temperature to 95 degrees.)

30 – ½ hour BWT sessions

Figure 2.
Mean (+SD) MMPI T-scores of the brainwave training experimental group (BWT) on three validity scales and ten clinical scales, before (PRE) and after (POST) treatment.
BFB/NFB BRIDGES THE GAP BETWEEN THE CONSCIOUS AND UNCONSCIOUS

Therapeutic Insights Occur

EX: Obese Vietnam Vet
“Eat a meal for me.”