

Jimmie L. Holman Paul V. Dorneanu Thomas D. Drake

An Introduction to PulsedTech's tDCS Technologies

Transcranial Direct Current Stimulation

Pulsed Technologies

VSG

PULSED

36

RESEARCH

Pulsed Technologies'

Transcranial Direct Current Stimulation

Physical & Functional Changes to the Brain

Focus, Attention, Concentration, Learning

Enhanced Motor Control and Endurance

 Mood, Depression, Addiction, Sleep



Physical Repair & Regeneration

www.PulsedTechResearch.com www.PulsedTech.com www.PulsedTech.RO

Physical & Functional Changes to the Brain

Focus, Attention Concentration, Learning

Enhanced Motor Control & Endurance

- Mood, Depression, Addiction, Sleep, ADHD, Autism
- Physical Repair, Regeneration, &
 Retraining

Functional Enhancements to the Brain

Enhancemen Competitive "Edge" in the Workplace

Memory

Meditation/ Focus

 Accelerated Learning and Recall

Brain Enhancement & Repair

 Maintain superior cognitive function and health throughout life





Realize true repair and reversal from brain damage of stroke and other trauma related assaults



Competitive "Edge"

 Increase Endurance and Precise Motor Control



Competitive "Edge" in Learning or Work

 Actor (Learning Lines)

Learning Disabilities (ADHD/Autism)



DARPA



 2.1x Improvement in non-threat detection accuracy

• **3.1x** Improvement for threats alone

tDCS Stimulation applied at 2 milliamps for 30 minutes = IMPROVEMENT IN LEARNING



•

Accomplishment: Direct Stimulation leads to 2x Improvement

tDCS stimulation applied to the right sphenoid (right temple) at 2 milliamps for 30 minutes provides an improvement in learning vs. sham in threat detection training

 2.1x improvement (p=0.0093) in threat and non-threat detection accuracy
 3.1x improvement for threats alone (p=0.0004)



Approved for Public Release, Distribution Unlimited



November 25, 2011

AMERICAN Safe" Brain Enhancement

Amping Up Brain Function: Transcranial Stimulation Shows Promise in Speeding Up Learning



Credit: Courtesy of Richard A. McKniev, 1845

R. Douglas Fields

Electrical stimulation of the brain is found to accelerate learning in military and civilian subjects, although researchers are wary of drawing larger conclusions about the mechanism

Numerous Articles are emerging as the practical advantages of tDCS are becoming public





ki jampers rely on linely famed skills to plick through the sir and land salely

Performance boost paves way for 'brain doping'

Electrical stimulation seems to boost endurance in preliminary studies.

BY SARA STATEOR

and power to descend the steep slopes fhat allow them to ceach up to 100 kilometres per hour. But the US Sle and Snowboard association (USSA) is sealing to give its effice athletes an edge by training a different muscle: the mind.

Working with Halo Neuroscience in San-Francisco, Cultórmia, the morts group is wellow. findings, but who known what they mean," any Four athleties received immacranial directwhether stimulating the brain with electricity cognitive psychologist Janed Hor with at the can improve the performance of eld jumpers by University of Melbourne in Australia.

making it easier for them to home facir skills. Other research suggests that targeted brain efficacy of a device that delivers dectricity to the This sky tumpers ruly on extreme balance stimulation can reduce an athlates ability to motor conter, an area of the beam that controls perceive fatigue¹, Such technologies could aid. recovery from injury or let athlates try 'hmin doping to gain a competitive advantage. Yet many scientists quantion whether brain. stimulation is as effective as its proponents claim, pointing out that studies have looked. at only small groups of people. "They're cool

The USSA is working with Halo to judge the physical skills. The company claims that the stimulation helps the brain to build new connections as it learns a shift. It tested its device in an any abilitated study of seven elite Nordic ski sumpers, including Olympic athletes. Four times per week, for two weeks, the skiers practised jumping onto an unstable platform.

current stimulation (tDCS) as they trained, the other three received a share proceeding. The 🕨

17 MARCH DELS | VOL S31 | NATURE | 383 @ 2016 Macro Rev.P. Michaels United All rights second

Practical Application

 The process is really as simple as strategically placing 2 color coded electrodes and running for 20-30 minutes.



What is tDCS?

- Method used to modulate cortical excitability, producing faciliatory or inhibitory effects upon a variety of behaviors
- Involves emission of weak electrical current via placement flowing between two electrodes to the scalp [Anode (+) & Cathode (-)]
- Positive Anode current facilitates behaviors associated with cortical region under target

Negative Cathode currrent inhibits behaviors under target

[Nitsche et al 2008]



Current Direction Flow (Polarity)

- Direction of current flow differentiates anodal and cathodal stimulation by modulating and resting membrane potential of the neurons stimulated [Nitsche & Paulus, 2000]
- Anodal stimulation DEPOLARIZES the neurons, increasing the probability of action potentials occurring [Nitsche et al., 2008]
- Cathodal Stimulation HYPERPOLARIZES neurons, decreasing the likelihood of action potentials occurring [Nitsche et al., 2008]
- The polarity specific effects have been demonstrated both during and continuing after stimulation [Antal et al., 2003; Priori, 2003]

Do I really have to understand all that?

NO



"Safe" Brain Enhancement

- We can safely enhance certain parts and activities of the brain by stimulating and increasing the electrical activity.
- We can tone down certain areas and activities of the brain, reducing electrical activity by controlling the direction of electrical flow.
- Regular use of tDCS has shown long term repair and improvement in the selectively targeted activities.
- The PulsedTech Workbook, Guide, and Kit makes the tDCS procedure really safe and easy!



Potentially Affected Fields of Science

Medicine

Physiology

Psychology

Pharmacology

Neuroscience

Biochemistry



tDCS Known Functional Improvements

Sensory

Attention

Motor

Memory

Mathematics

Language

High-Level
 Cognitive Function



Restoration of Memory

Published Literature

Reduction of Wariness

- Enlivenment (lasting for hours)
- Exhilaration
- Relief from Pain

 Increased Capacity for Labor and Thinking

 Increased Capacity for Exertion

Previous Known Uses

Neuroanesthenia

Depression

Neuralgia

• Tiredness

Fatigue



tDCS Exploration Workbook & Kit



tDCS Exploration Workbook

> Transcranial Direct Current Stimulation Experimentation Guide and Journal

Jimmie L. Holman & Thomas D. Drake

 The new PulsedTech Workbook/Guide and Kit provides all that is needed to SAFELY experiment with and experience tDCS technology.

tDCS Exploration Kit



ap

Pulsed Technologies' tDCS kit is a "multi" instrument:

- Safe tDCS Power Source to Electrodes*
- Book, Workbook, Reference Materials, Note & Workspace**

* user selectable current output limiting
** on internal flash drive

ww.PulsedTech.com

tDCS Workbook and Guide

- The Workbook and Guide is Embedded within the unit's internal Flash drive
- Updates can be downloaded and added when available.
- Workbook can be printed in parts or whole
- Notes can Journal can be kept within unit



TI

tDCS Exploration

Workbook

tDCS Practical Application



10













00:14:52

 The tDCS electronics can be safely connected in a variety of ways





tDCS Safety

Primary Areas of Interest (Focus)

Parietal Lobe

- No

Occipital Lobe

Shoulder & Neck Frontal Lobe

Temporal Lobe

Brain Area Physical Relationship



Generalized Left-Right Brain Function

LEFT-BRAIN FUNCTIONS

Analytic thought

Logic

Language

Reasoning

Science and math

Written

Numbers skills

Right-hand control



RIGHT-BRAIN FUNCTIONS

> Art awareness Creativity Imagination Intuition Insight Holistic thought Music awareness 3-D forms

Left-hand control

Understanding WHERE certain types of processing occurs and the relationship to other areas is "key" to targeted enhancement!



Absent Mindedness

www.PulsedTechResearch.com www.PulsedTech.com www.PulsedTech.R

10-20 Transcranial Positioning System



Simplified Target Locations

15

13

F7/

FP1

0)1

 tDCS utilizes generalized target areas

 $\left(\right)$

FP2

16

r21



ADHD & Impulse Control

Electrode Placement

Anode: FZ Cathode: Left Cheek

Montage Effect Anodal stimulation of Presupplementary motor area (Pre-SMA) (Fz) improves efficiency of inhibitory control.



Formal Study and /or Associated

Papers

Modulating inhibitory control with direct current stimulation of the superior medial frontal cortex, Tzu-Yu Hsu, 2011

Abstract of Paper

The executive control of voluntary action involves not only choosing from a range of possible actions but also the inhibition of responses as circumstances demand. Recent studies have demonstrated that many clinical populations, such as people with attention-deficit hyperactivity disorder, exhibit difficulties in inhibitory control. One prefrontal area that has been particularly associated with inhibitory control is the presupplementary motor area (Pre-SMA). Here we applied non-invasive transcranial direct current stimulation (tDCS) over Pre-SMA to test its role in this behavior, tDCS allows for current to be applied in two directions to

Transcranial Direct Current Stimulation - Experimentation Guide and Journal



Depression and Anxiety

reaction times when init response to happy com expressions. Gender dic

Transcranial Direct Current Stimulation - Experimentation Guide and Journal



Formal Study and/or Associated Papers Using transcranial direct current stimulation (tDCS) to treat stroke patients with aphasia, Baker, 2010

Abstract of Paper

background and Purpose-Recent research suggests that increased left hemisphere cortical activity, primarily of the left frontal cortex, is associated with improved naming performance in stroke patients with aphasia (PWA). Our aim was to determine if anodal transcranial direct current stimulation (A-tDCS), a method thought to increase contical excitability, would improve naming accuracy in PWA when annied to the scain overhing the left frontal cortex

Methods -- Ten patients with chronic stroke-induced aphasia received five days of A-tOCS (1 mA-20 min) and five days of tham tOCS (5 tDCS; 20 min, order randomized) while performing a computerized anomia treatment, tDCS positioning was guided using a priori functional MRI results for each individual during an overt naming task to ensure the active electrode was placed over structurally-intact

Results-Results revealed significantly improved naming accuracy of treated items (\$(1,9) = 5.72, p < 0.040) following A-EDCS as compared to 5-tDCS. Patients who demonstrated the most improvement were those with perilesional areas closest to the stimulation

site. Crucially, this treatment effect persisted at least one-week post-treatment. Conclusions - Our findings suggest that A-tOCS over the left frontal cortex can lead to enhanced namine accuracy in PWA and, if proved to be effective in larger studies, may provide a supplementary treatment approach for anomia.

Transcranial Direct Current Stimulation - Experimentation Guide and Journal



Treat Aphasia in Stroke Patients

Electrode Placement

The tDCS Exploration Workbook

sham-controlled within selected a homogeneou

healthy participants. By

measures and event rel indexes, we aimed to in single session of anodal

dorsolateral prefrontal

have specific effects in (

control for positive and

stimuli. After tDCS over

sham control stimulatio

negative N450 amplitud

Anode: F3 Cathode: Right Shoulder

Montage Effect Anodal stimulation of the left dorsolateral

prefrontal cortex (F3) with cathodal stimulation of right shoulder improves naming performance in stroke patients with anhasia



ntag

Sample Montages

Transcranial Direct Current Stimulation - Experimentation Guide and Journal

Cathode: FP2

Cathode: FP1

Formal Study and/or Associated Papers

A randomized, sham-controlled, proof of principle study of

transcranial direct current stimulation for the treatment of

pain in fibromyalgia. Fregni, 2006





Sumple Montages





Montage Information Highlights CLEARLY ILLUSTRATED LOCATIONS

ELECTRODE PLACEMENT

• INTENDED EFFECT

FORMAL STUDY and/or ASSOCIATED PAPERS



Reduced Pain

Anode: C3 Cathode: FP2 Anode: C4 Cathode: FP1

Montage Effect Anodal stimulation of primary motor cortex (C3, C4) relieves pain in patients with fibromyalgia.

Formal Study and/or Associated Papers A randomized, sham-controlled, proof of principle study of transcranial direct current stimulation for the treatment of pain in fibromyalja. Fregni, 2006





Transcranial Direct Current Stimulation – Experimentation Guide and Journal

The tDCS Exploration Workbook

Abstract of Paper

OBJECTIVE:

Recent evidence suggests that fibromyalgia is a disorder characterized by dysfunctional brain activity. Because transcranial direct current stimulation (tDCS) can modulate brain activity noninvasively and can decrease pain in patients with refractory central pain, we hypothesized that tDCS treatment would result in pain relief in patients with fibromyalgia.

METHODS:

Thirty-two patients were randomized to receive sham stimulation or real tDCS with the anode centered over the primary motor cortex (MI) or the doorsalteral performation cortex (DIFFC) (LM for 20 minutes of 5 consecutive days). A blinded evaluator rated the patient's pain, using the visual analog scale for pain, the clinician's global impression, the patient's global assessment, and the number of tender points. Other symptoms of flioromyalgia were evaluated sign the Flioromyalgia impact Questionnaire and the Short form 36 health Survey. Safety was assessed with a battery of neuropsychological tests. To assess potential confounders, we measured mood and anivery changes throughout the trial.

RESULTS:

Anodal IOCS of the primary motor cortex induced significantly greater piain improvement compared with sham stimulation and stimulation of the DLPFC (P < 0.0001). Although this effect decreased after treatment ended, it was still significant after 3 weeks of followup (P = 0.004). A small positive impact on quality of life was observed among patients who received anodal M1 stimulation. This treatment was associated with a few mild adverse events, but the frequency of these events in the active-treatment groups was similar to that in the sham group. Cognitive changes were similar in all 3 treatment groups.

CONCLUSION:

Our findings provide initial evidence of a beneficial effect of tDCS in fibromyalgia, thus encouraging further trials.

User Notes

USER NOTES

ABSTRACT/

SUMMARY

Transcranial Direct Current Stimulation – Experimentation Guide and Journal

Journal Worksheet

Printable Journal • Worksheets are included for recording users' progress, experimentation, and planning

	Montage Name/Experiment
	FP2 FP1
DATE/	Contact Points (murit selected points gbygg)
TINAR	Date Time (of Day) Montage Time (in Minutes)
TIVIE	Purpose
	EFFECT
	Observations/Results
	OBSERVED
	RESULTS
	Notes (recommendations for next session)
	• USER
	Transcranial Direct Current Stimulation – Experimentation Guide and Journal 150

USER TIT

LECTRODE LACEMENT