

# tDCS Montage

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REFERENCE

Trans Cranial Technologies

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# 1 Introduction

## General Introduction

Transcranial Direct Current Stimulation (tDCS) is a technique that has been investigated intensively in the past decade. The effects of tDCS depends on the polarity of the stimulation electrodes. Cathodal (-) stimulation induces a decrease in cortical excitability, and Anodal (+) stimulation induces an increase in cortical excitability that lasts beyond the duration of stimulation.

Variation of electrode sizes leads to variations of focal effects and efficiency. With a decrease of the diameter of the electrode, a more focal stimulation can be achieved. By increasing the electrode size it is possible to have a less strict electrode placement, but at the risk of having functionally ineffective electrode.

A number of useful montages have been investigated and published over the past decade. We here show a small subset of different alternatives for placement of electrodes in tDCS applications such as depression and modulating pain.

For positioning the electrodes, it is helpful to fall back to the international 10/20 EEG-system. The 10/20 system is an internationally recognized method to describe the location of scalp electrodes. The system is based on the relationship between the location of an electrode and the underlying area of cerebral cortex.

For more information on how to accurately measure the 10/20 positions, please refer to the '10/20 System Positioning Manual'.

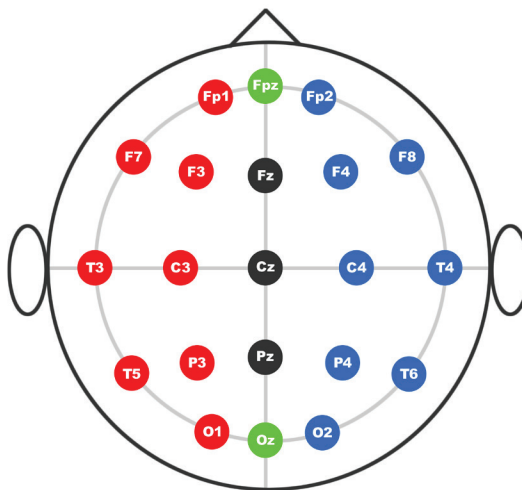


Fig 1. 10/20 EEG-System

# 2 Montages for Depression

## Table

Anode (+)	Cathode (-)	Use	Comments	Fig
DLPFC (F3)	Supra-orbital (FP2)	Depression (Pain)	-Most frequently used montage for depression. -Provides positive results for depression and pain syndromes.	2a
DLPFC (F3)	Extra-cranial (Right upper arm)	Depression	-Avoids the confounding effect of two electrodes with opposite polarities in the brain.	2b
DLPFC (F3)	DLPFC (F4)	Depression (Pain)	-Bi-hemispheric stimulation. Can be useful in case of hemispheric imbalance. -Shunting can occur due to the limited distance between Anode and Cathode.	2c

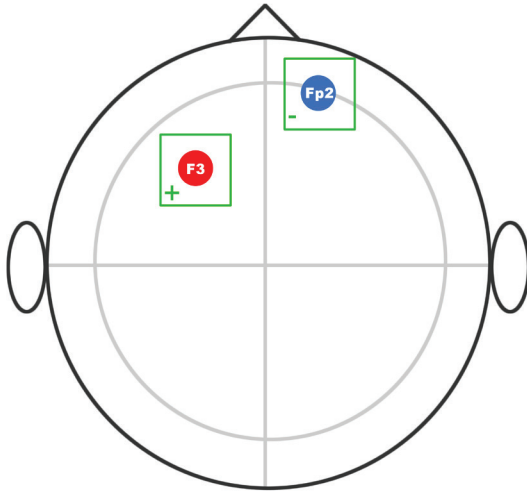
## Notes

In patients with bipolar disorder, there is a risk of triggering a hypo-manic episode.

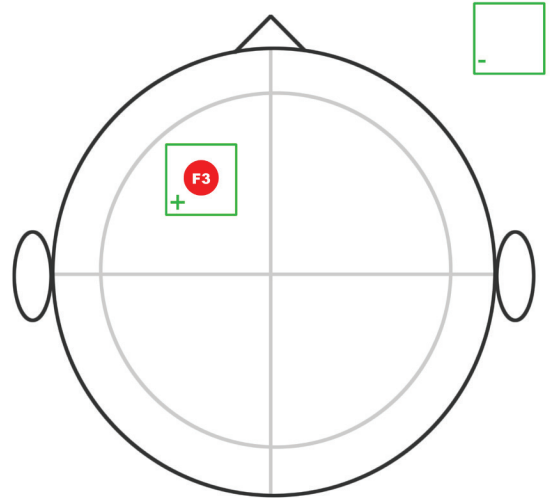
Bi-hemispheric stimulation can influence risk taking behaviour.

Unilateral Anodal stimulation of the DLPFC (F3) has not shown to influence risk taking behaviour.

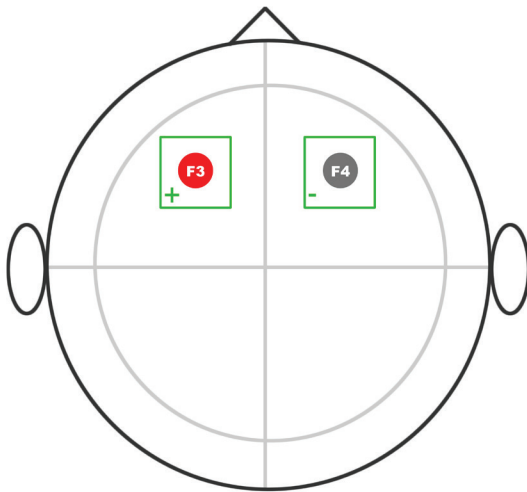
## Montages



*Fig 2.a. F3/FP2 stimulation for depression.*



*Fig 2.b. F3/Extra-cranial stimulation for depression.*



*Fig 2.c. F3/F4 stimulation for depression.*

# 3 Montages for Modulating Pain

## Table

Anode (+)	Cathode (-)	Use	Comments	Fig
M1 (C3)	Supra-orbital (FP2)	Pain (Sleep)	-Most frequently used montage for pain. -Stimulating only one side could be a problem for bi-lateral pain syndromes.	3a
M1 (C4)	Supra-orbital (FP1)	Pain	-Mirror of the previous montage.	3b
M1 (C3)	M1 (C4)	Pain	-Bi-hemispheric stimulation. Can be useful in case of hemispheric imbalance. -Shunting can occur due to the limited distance between Anode and Cathode.	3c
M1 (C4)	M1 (C3)	Pain	-Mirror of the previous montage.	3d
M1 (C3+C4)	Supra-orbital	Pain	-Large electrode surface may make the stimulation less effective.	3e
DLPFC (F3)	Supra-orbital (FP2)	Pain (Depression)	-Most frequently used montage for depression. -Has show to be effective in lowering symptoms associated with pain.	3f

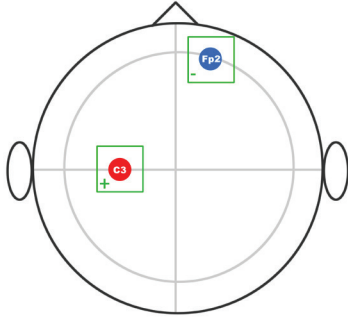
## Notes

This is only a subset of possible montages.

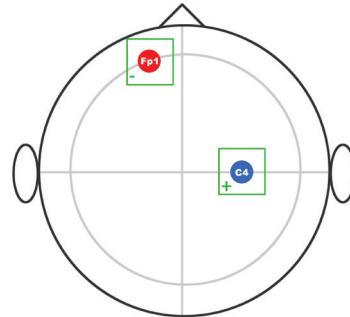
Anodal tDCS over M1 modulates the pain threshold, leading to improvement in visual analogue scale (VAS) pain ratings.

The effect has been documented in patients with neuropathic pain syndromes like trigeminal neuralgia, poststroke pain syndrome, back pain and fibromyalgia.

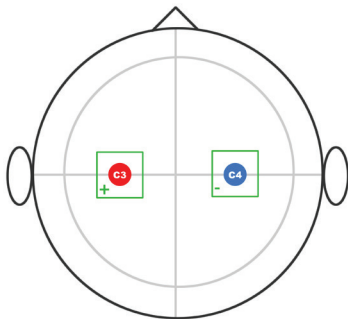
## Montages



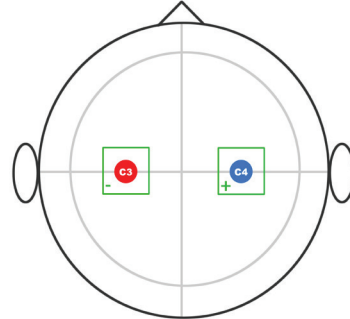
*Fig 3.a. C3/FP2 stimulation for pain.*



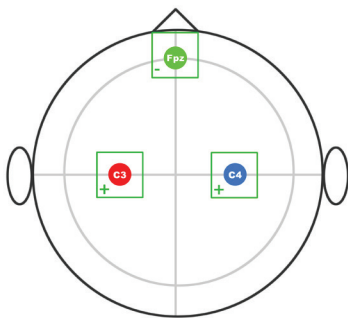
*Fig 3.b. C4/FP1 stimulation for pain.*



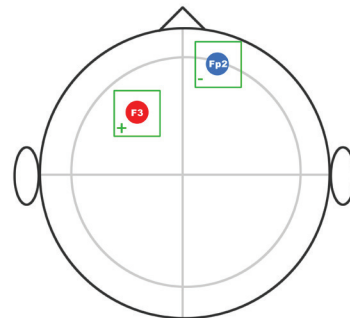
*Fig 3.c. C3/C4 stimulation for pain.*



*Fig 3.d. C4/C3 stimulation for pain.*



*Fig 3.e. C3+C4/FP stimulation for pain.*



*Fig 3.f. F3/FP2 stimulation for pain.*



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