The Effect of tDCS on the Consolidation of Fear Extinction Memory

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To evaluate the effect of tDCS (anodal and cathodal) to the right dorso-lateral prefrontal cortex on the consolidation of fear extinction memory in healthy volunteers as compared to sham tDCS (control) as measured by psychophysiological measures (...

Ethical review	Approved WMO
Status	Will not start
Health condition type	Anxiety disorders and symptoms
Study type	Interventional

Summary

ID

NL-OMON40851

Source
ToetsingOnline

Brief title
tDCS and Fear Regulation

Condition

- Anxiety disorders and symptoms

Synonym
anxiety, fear

Research involving
Human

Sponsors and support

Primary sponsor: Academisch Medisch Centrum
Source(s) of monetary or material Support: ZonMW

Intervention

Keyword: consolidation, extinction, fear, tDCS

Outcome measures

Primary outcome

Psychophysiological measurements

o Skin Conductance Response (SCR)/Galvanic Skin Response

o Startle response

Secondary outcome

• Self-report questionnaires

Study description

Background summary

Exposure therapy is a prevalent method in the treatment of anxiety disorders. However, for many patients this extinction-based treatment is not, or only partially, beneficial (McNally, 2007). In anxiety research, classical fear conditioning and extinction paradigms are commonly used to study the nature of fear responses. In a conditioning phase, a neutral stimulus (CS) is paired with an unconditioned aversive stimulus (US) and will be repeatedly presented. At the end of the conditioning phase, presentation of the previously neutral stimulus (CS+) will elicit a fear response even in the absence of the US. In an extinction phase, the CS+ will be repeatedly presented without the US which will result in a new safety memory of the previously aversive stimulus. The recall of this fear extinction memory is typically tested 24 hours later.
Previous studies have shown that the recall of fear extinction memories is dysfunctional in individuals with anxiety disorders (e.g. post-traumatic stress disorder) indicating that the consolidation of the extinction memory is impaired (Milad et al., 2009). In recent studies, transcranial direct current stimulation (tDCS) has been shown to have the capacity of impacting the consolidation of memories. tDCS might therefore provide a new means to facilitate the effects of extinction-based therapies.
It is generally considered that anodal tDCS increases neuronal excitability while cathodal stimulation decreases neuronal excitability of the stimulated area (ref). However, while this polarity effect has been consistently observed when tDCS was applied over motor areas, heterogenous effects have been found

in tDCS studies investigating its effect on cognitive functions (Jacobson et al., 2011). In cognitive tasks, anodal stimulation was found to consistently cause excitatory effects, inhibitory effects, however, were not observed after cathodal stimulation.
Only few studies have investigated the impact of tDCS on fear memories. In a recent study, Asthana et al. (2013) showed that cathodal transcranial direct current stimulation (tDCS) over the right dorsolateral prefrontal cortex (dlPFC) disrupts the consolidation of conditioned fear memories when compared to sham stimulation. Anodal tDCS over the right dlPFC was shown to enhance fear memories (as measured by skin conductance responses) when applied after the presentation of a reminder of the previous learned fearful stimulus (Mungee et al., 2013). The effect of tDCS on the consolidation of fear extinction memories has not been investigated. The aim of this research is to investigate whether transcranial direct current stimulation over the right dorso-lateral prefrontal cortex (dlPFC) enhances the consolidation of extinction memory when administered directly after extinction training. This is of clinical significance for the successful treatment of anxiety disorders.

Study objective

To evaluate the effect of tDCS (anodal and cathodal) to the right dorso-lateral prefrontal cortex on the consolidation of fear extinction memory in healthy volunteers as compared to sham tDCS (control) as measured by psychophysiological measures (SCR and startle response). It is anticipated that anodal stimulation will facilitate the consolidation of extinction memory while cathodal stimulation will disrupt/interfere with extinction memory consolidation.

Study design

The present study is a placebo-controlled double-blind design. Volunteers will participate in three sessions in an observational study. On day 1, participants will perform a Pavlovian conditioning paradigm with a neutral stimulus and an aversive stimulus paired with a mild electric stressor. On the second day, participants will undergo an extinction paradigm. Subsequently, subjects will receive tDCS (anodal or cathodal) or sham stimulation to the dorso-lateral prefrontal cortex. On day 3, participants will perform an extinction recall and reinstatement paradigm which will involve a mild electric stressor. The first session will last approximately 45min, the second 60min, and the third session will last for approximately 45 min. All study sessions will be performed at the Psychiatry Department of the AMC. Subjects* personality variables will be assessed using several questionnaires.
As directionality of anodal and cathodal tDCS stimulation is not yet fully established, both polarities will be investigated.

Intervention

transcranial direct current stimulation

Study burden and risks

The proposed tDCS procedure is safe and does not carry any significant risk. Safety guidelines will be followed to ensure participant*s safety. Potential side-effects of tDCS are itching and tingling sensations under the electrodes (Nitsche et al., 2008). tDCS will be applied with a current intensity of 1mA over a time period of 20 min. For sham stimulation, the current will be ramped up and then down again to simulate the feeling of active stimulation. Volunteers can withdraw from the study at any given time and there are no direct benefits for the participants.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)
Elderly (65 years and older)

Inclusion criteria

right-handed
18-35 years

Exclusion criteria

Skin disease
Epilepsy
Left-handedness
Metal objects in and around the head
History of psychiatric treatment and current psychiatric treatment

Study design

Design

Study type:	Interventional
Intervention model:	Parallel
Allocation:	Randomized controlled trial
Masking:	Double blinded (masking used)
Control:	Placebo
Primary purpose:	Treatment

Recruitment

NL

Recruitment status:	Will not start
Enrollment:	78
Type:	Anticipated

Ethics review

Approved WMO

Date:	04-09-2014
Application type:	First submission

Review commission: METC Amsterdam UMC

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL48329.018.14