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Combining Brain Stimulation Methods for a Higher Chance of Anxiety Reduction

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Dear Sir/Madam,

There is a huge amount of studies on electrical stimulation and its effect on anxiety. Since there are different methods of stimulation, including transcranial Direct Current Stimulation (tDCS), transcranial Alternating Current Stimulation (tACS), transcranial Pulsed Current Stimulation (tPCS), transcranial Random Noise Stimulation (tRNS) and Cranial Electrotherapy Stimulation (CES); this letter aims to compare the efficacy of these methods (three of them) on anxiety and suggest new modalities and experiment designs for a higher chance of anxiety treatment/reduction.

It has been demonstrated that Dorso-Lateral Prefrontal Cortex (DLPFC) is an important region of brain, playing role in anxiety disorders [1], Lower activity of left DLPFC is related to negative emotional judgment, and on the other hand right DLPFC hyperactivity is associated with attentional modulation.

So we are going to focus on these regions for tDCS modulation and other brain areas for other methods which we will talk about later in the text.

Below we refer to one study for each stimulation method (tDCS, tACS and CES), which their outcome shows anxiety reduction in participants.

Study Number 1

Using tDCS method for anxiety [2].

Heeren et al., 2017 showed that using a single session of tDCS at 2 mA for women with a primary diagnosis of Social Anxiety Disorder, can help them reduce their attentional bias for threat.

In this study the Anodal electrode was placed on left DLPFC and cathode was placed on ipsilateral arm, anodal stimulation of left DLPFC can make this region more active, so that based on what we told earlier about DLPFC activity and its relationship with anxiety, the more active left DLPFC is, the less negative emotional judgment people have.

Study Number 2

Using tACS method for anxiety [3].

Clancy et al., found that tACS alpha-stimulation can lead to a consistent and lasting reduction in anxious arousal.

In their study, the electrodes were placed on occipitoparietal sites, with a 4×1 montage, in which the central electrode receives electrical current from the four surrounding electrodes.

The occipitoparietal area was chosen because it had been demonstrated that patients with PTSD have reduced alpha oscillations in this area of their brain [4].

They stimulated this region for 30 minutes with eyes open, using a ± 2 mA sinusoidal current at specific occipitoparietal PAF for each participant. The PAF is the peak frequency within the alpha range (8-12 Hz) which they calculated it by recording the EEG of participants.

Study Number 3

Using CES for anxiety [5].

Cranial Electrotherapy Stimulation (CES) is a method by which two electrodes are attached to the earlobes so that a micro current of electricity passes through cranium.

Wonkang et al., showed the high efficacy of using CES on anxiety reduction in their study.

Their participants were people with a history of hypertension, scheduled to undergo general

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anesthesia.

A 20-minute session of stimulation on the day before surgery and day of surgery was applied for participants in CES group with less than 200 mA and 0.5 HZ. Comparing to control group, using this method is highly efficient in reducing anxiety.

The Combination Method

As all these methods are efficient for anxiety reduction, each in their own special way. We suggest combining these methods for a better chance of anxiety reduction/treatment. The combination method can be applied in three 20-minute sessions with a day of rest in between.

The tACS method can be used with CES at the same time for session 1.

The tDCS method alongside CES can be applied for participants in session 2.

And for the last session we can combine tDCS with tACS method.

In our next study we will put this design into practice to see whether if this combination, compared to each single method, is more effective on anxiety reduction or not.

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