Transcranial Direct Current Stimulation: A possible intervention for obesity?

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What is tDCS?

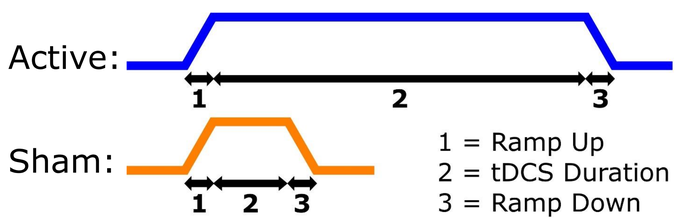
Transcranial direct current stimulation (tDCS) is a non-invasive method of brain stimulation, which applies a continual weak electrical current to the brain via electrodes placed on the scalp[1,2].

This stimulation elicits changes in neuronal excitability, and is growing in popularity due to it being a relatively simple, scalable and cost-effective method of neuromodulation[1,2,3].

Magstim (magstim.com/product/25/hdckit)

Standard Protocol

- Current intensity: 1 - 2 mA
- Duration: up to 20 minutes
- Ramp current up/down (~30sec)
- Sham as blinding technique



Effects

- When measuring motor evoked potentials (MEPs)[1];

  Anodal tDCS increases neuron excitability

  Cathodal tDCS diminishes neuron excitability

- Effects of stimulation outlast stimulation duration. For example, 13 mins of anodal tDCS over the motor cortex increases MEPs for up to 150 mins post-stimulation[2].

Safety

- Standard protocols are safe for adults and children[4].
- There is a risk of mild adverse events (e.g. slight itching, tingling, redness under the electrode pads)[4].
- A meta-analysis failed to find any record of serious adverse events in >33,200 stimulation sessions[5].
- Extensive screening procedures are used to lower risk of adverse events.

Reliability

- Inconsistency between- and within-groups[6];

Inter- and intra-individual differences
e.g. anatomy, baseline state, neurochemistry, hormones, medications, gender, age

tDCS outcome

Offline and online tasks / Rested or active state

Stimulation parameters
e.g. current intensity, duration, pauses, direction of current, type of electrode, prior exposure

tDCS and Obesity

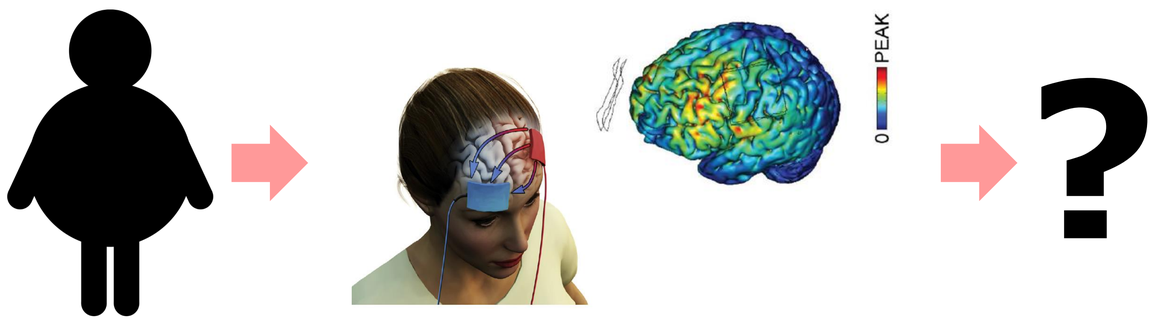
The majority of tDCS research has been conducted in a young, healthy and physically active population. This work suggests eating and exercise behaviour can be improved following tDCS[3].

In an overweight and obese population, anodal tDCS (2 mA for 20 minutes) over the dorsolateral prefrontal cortex has significantly reduced[7,8,9,10,11];

Total daily **calorie intake**, specifically for fat and soda

General, sweet and carbohydrate **food craving**

Desire to eat (more pronounced when combined with exercise)



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Is tDCS a viable intervention for obesity?

Potentially, but there any many questions we need to answer…

What area of the brain should we target?

At what stage in weight loss should tDCS be applied?

What is the optimal current intensity and stimulation duration?

How many stimulation sessions are appropriate?

Should tDCS be used alone, or alongside other interventions?

Are the effects of tDCS dependent on current behaviour?

Is it a cost-effective intervention?

Can it be delivered safely to a large population?

Does tDCS improve behaviour sufficiently to warrant its use?

tDCS at Leeds Trinity University

Can tDCS be used to improve dietary and exercise behaviour?

In answering this question, we aim to;

- Develop the current understanding around eating and exercise behaviours of overweight individuals
- Assess the efficacy of tDCS on behaviour change
- Determine the effects of tDCS on diet and physical activity in an overweight population
- Further develop tDCS protocols used for eating/exercise behaviours

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