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Assessing the effects of brain stimulation on sleep in people with insomnia

Submission date
18/06/2019

Recruitment status
Suspended

Registration date
21/06/2019

Overall study status
Completed

Last Edited
16/04/2020

Condition category
Mental and Behavioural Disorders

[X] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[ ] Results
[ ] Individual participant data
[ ] Record updated in last year

Plain English summary of protocol

Background and study aims
Adults experience problems with their sleep on a regular basis. The researchers want to understand how a brain stimulation technique called transcranial direct current stimulation (tDCS) may be used to improve sleep and daytime functioning in people with disturbed sleep. tDCS is a non-invasive, painless and well-tolerated method that has been applied in experimental and clinical settings to influence brain activity. The researchers want to look at changes in sleep and vigilance between a night with tDCS and one night without such stimulation (sham stimulation).

Who can participate?
Men and women aged 25-65 with poor sleep, who are right-handed, able to read and understand English, and complete the study screening procedures

What does the study involve?
Interested participants are screened for suitability through an online questionnaire and a telephone interview with a member of the research team. Once eligibility has been determined and consent acquired, participants undergo two experimental nights at the sleep laboratory; one night with cathodal tDCS and one night with sham stimulation before the sleep period (order of nights is random). Before the study nights, participants wear an actimeter and complete a sleep diary. During the study nights, polysomnography (throughout the night) and resting state EEG (before and after the stimulation and in the morning) are performed to assess objective sleep parameters and markers of cortical arousal. Furthermore, participants perform tasks to assess their cognitive functioning and fill out questionnaires assessing their sleep. Before sleep participants undergo 20 minutes of tDCS or sham stimulation. Furthermore, subjective daytime functioning is evaluated at four timepoints throughout the next day (after waking up, 12 am, 3 pm and 6 pm).

What are the possible benefits and risks of participating?
There is no direct benefit from taking part in this study. It is hoped that the information obtained from this research will help improve the understanding of what causes insomnia and how best to treat it. In the long-term this may support the development of new treatments for insomnia. Participants will be reimbursed for their time and all participants who are interested in

receiving a summary of the study findings will be sent a copy of this at the end of the study. There are no known serious side effects from taking part in this study. The sensors and electrodes for the PSG/EEG recordings are commonly used in sleep research and are non-invasive. They are temporarily attached to the skin of the participant using medical tape or a water-soluble paste. EEG is a procedure for measuring brain waves. It is harmless and painless and carries no significant risk to participants. EEG recording has been used safely for many years, and the researchers are not aware of any cases of adverse events, but slight irritation and abrasion of skin can occur due to the cleaning and preparation required. EEG equipment comes from certified suppliers of medical equipment, who are obliged by law to adhere to published guidelines on electrical and mechanical safety (IEC-601). Transcranial electrical stimulation is a technique that has been used extensively worldwide and with which the researchers have extensive experience. They will conform to the International Safety Guidelines as described in 2003. Because tDCS neither causes epileptic seizures nor reduces the threshold for induced seizures in animals, seizures do not appear to be a risk for healthy participants. However, this may not be true for patients with epilepsy. As a result, the researchers will ensure that all participants are free of unstable medical conditions, or any illness that may be negatively affected by stimulation, for example, neurological diseases such as epilepsy or acute eczema under the electrodes. The researchers will also ensure participants have no metallic implants near the electrodes. Participants will be informed about the possible side effects of tDCS, such as headache, dizziness, nausea, and an itching sensation as well as skin irritation under the electrodes. All stimulation will be carried out in a dedicated environment and two investigators will be present at all times, at least one of whom will be trained in life support.

Where is the study run from?
The study is run by the University of Oxford. The study takes place at the Sleep and Circadian Neuroscience institute (SCNi), University of Oxford or in the sleep laboratory at the Clinical Research Facility at the Warneford Hospital, Oxford (UK)

When is the study starting and how long is it expected to run for?
June 2018 to May 2020

Who is funding the study?
1. Dr Mortimer & Theresa Sackler Foundation
2. National Institute for Health Research (NIHR) Oxford Biomedical Research Centre (BRC)
3. Swiss National Science Foundation

Who is the main contact?
1. Dr Simon Kyle
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Contact information

Type(s)
Scientific

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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

ClinicalTrials.gov (NCT)
Nil known

Protocol serial number
R62079

Study information

Scientific Title
Modulation of sleep and arousal using transcranial direct current stimulation in insomnia

Study objectives
The primary hypothesis for the trial is:
1. Cathodal tDCS will reduce cortical arousal in participants with insomnia relative to sham stimulation

Secondary hypotheses for the trial are:
1. Cathodal tDCS will increase subjective sleepiness and reduce subjective and objective arousal relative to sham stimulation
2. Cathodal tDCS will reduce sleep onset latency and improve sleep continuity relative to sham stimulation
3. Cathodal tDCS will lead to a reduction in cortical arousal after the sleep period relative to sham stimulation
4. Cathodal tDCS will lead to improvements in sleep-dependent cognition and daytime functioning relative to sham stimulation

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 08/04/2019, Medical Sciences Inter-Divisional Research Ethics Committee (Research Services, University of Oxford, Wellington Square, Oxford, OX1 2JD; Tel: 44 (0)1865 616577; Email: ethics@medsci.ox.ac.uk), ref: R62079/RE001

Study design
Single-centre interventional randomized-controlled double-blind cross-over trial

Primary study design
Interventional

Study type(s)
Treatment

Health condition(s) or problem(s) studied
Insomnia

Interventions
Interested participants will be screened for suitability through an online questionnaire and a telephone interview with a member of the research team. Once eligibility has been determined, and consent acquired, participants will undergo two experimental nights at the sleep laboratory; one night with cathodal tDCS and one night with sham stimulation prior to the sleep period (order of nights is randomised). Participants will be randomly allocated to treatment order (real stimulation first then sham; sham first then real stimulation) in a counterbalanced manner. This is a double-blind study; the experimenter will also be blind to the stimulation delivered.

Prior to sleep, participants will undergo 20 min of cathodal transcranial direct current stimulation (bifrontal stimulation; max 2mA; current will be ramped up over 10 s, held for 20 min, and then ramped down over 10 s) or sham stimulation (current will be ramped up over 10 s and then switched off; standard protocol for credible tDCS sham stimulation).

Prior to the study nights, participants will wear an actimeter and complete a sleep diary. During the study nights, polysomnography (throughout the night) and resting state EEG (before and after the stimulation and in the morning) will be performed to assess objective sleep parameters and markers of cortical arousal. Furthermore, participants will perform tasks to assess their cognitive functioning and fill out questionnaires assessing their sleep. Furthermore, subjective daytime functioning will be evaluated with the Daytime Insomnia Symptom Scale completed by the participant at four timepoints throughout the next day (after waking up, 12 am, 3 pm and 6 pm).

Intervention Type
Other

Primary outcome(s)
Cortical arousal measured using resting state EEG activity pre and post stimulation during assessment nights

Key secondary outcome(s))
1. Sleepiness and subjective and objective arousal measured using Karolinska sleepiness scale, pre-sleep arousal scale and Psychomotor Vigilance Task pre and post stimulation during assessment nights
2. Sleep onset latency and sleep continuity measured using polysomnographic (PSG) sleep data recorded during assessment nights
3. Cortical arousal after the sleep period measured using resting state EEG activity after sleep period (both assessment nights)
4. Sleep-dependent cognition and daytime functioning measured using declarative memory task (overnight performance improvement) and daytime insomnia symptom scale (DISS) at pre- and post-assessment nights (memory task), after the sleep period (DISS), and at four timepoints during the day (after waking up, 12 am, 2 pm and 6 pm)

Completion date
31/05/2020

Eligibility

Key inclusion criteria

Current inclusion criteria as of 11/03/2020:
1. Participant is willing and able to give informed consent for participation in the study
2. Male or female, aged 18-65 years
3. Screening positive for persistent insomnia (chronicity >3 months) as indicated on the Sleep Condition Indicator
4. Sleep onset difficulties with or without sleep maintenance problems
5. Increased pre-sleep arousal (pre-sleep arousal scale)
6. Score ≤ 2 on the Sleep Condition Indicator questions 5 or 6 (daytime impairment)
7. Typical sleep period takes place within the hours of 10 pm – 9 am
8. Can read and understand English
9. Normal or corrected to normal vision (visual, computer-based, tasks comprise part of the experiment)

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Previous inclusion criteria:
1. Participant is willing and able to give informed consent for participation in the study
2. Male or female, aged 25-65 years
3. Screening positive for persistent insomnia (chronicity >3 months) as indicated on the Sleep Condition Indicator
4. Sleep onset difficulties with or without sleep maintenance problems
5. Increased pre-sleep arousal (pre-sleep arousal scale)
6. Score ≤ 2 on the Sleep Condition Indicator questions 5 or 6 (daytime impairment)
7. Typical sleep period takes place within the hours of 10 pm – 9 am
8. Can read and understand English
9. Normal or corrected to normal vision (visual, computer-based, tasks comprise part of the experiment)
10. Right handed

Participant type(s)
Other

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 years

Upper age limit
65 years

Sex
All

Key exclusion criteria
Current exclusion criteria as of 11/03/2020:
1. Unstable physical or mental health problems that may explain sleep disturbance
2. Probable additional sleep disorders (e.g. sleep-disordered breathing or periodic leg movements during sleep assessed via questionnaire and interview)

3. Habitual night shift, evening, or rotating shift-workers
4. Undergoing a psychological treatment programme for insomnia with a health professional
5. Medication use (central nervous system agents including hypnotics)
6. Previous participation in tDCS study
7. Substance abuse
8. Pregnancy
9. Psychosis or epilepsies
10. A score within the clinical range for depression (>14) or anxiety (>14) on Hospital Anxiety and Depression Questionnaire (HADS)
11. Learning disability
12. Skin allergies or very sensitive skin
13. Diagnosis of a neurological condition (e.g. epilepsy, stroke, multiple sclerosis)
14. Contraindications to tDCS (including, but not limited to metal in the head or medical devices implanted in the brain, epilepsy)

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4. Undergoing a psychological treatment programme for insomnia with a health professional
5. Medication use (central nervous system agents including hypnotics)
6. Previous participation in tDCS study
7. Substance abuse
8. Pregnancy
9. Psychosis or epilepsies
10. A score within the clinical range for depression (>7) or anxiety (>10) on Hospital Anxiety and Depression Questionnaire (HADS)
11. Learning disability
12. Skin allergies or very sensitive skin
13. Diagnosis of a neurological condition (e.g. epilepsy, stroke, multiple sclerosis)
14. Contraindications to tDCS (including, but not limited to metal in the head or medical devices implanted in the brain, epilepsy)

Date of first enrolment
25/06/2019

Date of final enrolment
01/06/2020

Locations

Countries of recruitment
United Kingdom

England

Study participating centre

University of Oxford
Oxford
United Kingdom
OX1 3RE

Sponsor information

Organisation
University of Oxford

ROR
https://ror.org/052gg0110

Funder(s)

Funder type
Government

Funder Name
National Institute for Health Research (NIHR) Oxford Biomedical Research Centre (BRC)

Alternative Name(s)
National Institute for Health Research, NIHR Research, NIHRresearch, NIHR - National Institute for Health Research, NIHR (The National Institute for Health and Care Research), NIHR

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
United Kingdom

Funder Name
Dr. Mortimer and Theresa Sackler Foundation

Alternative Name(s)

Funding Body Type
Private sector organisation

Funding Body Subtype
Trusts, charities, foundations (both public and private)

Location
United Kingdom

Funder Name
Schweizerischer Nationalfonds zur Förderung der Wissenschaftlichen Forschung

Alternative Name(s)
Schweizerischer Nationalfonds, Swiss National Science Foundation, Fonds National Suisse de la Recherche Scientifique, Fondo Nazionale Svizzero per la Ricerca Scientifica, Fonds National Suisse, Fondo Nazionale Svizzero, Schweizerische Nationalfonds, The Swiss National Science Foundation (SNSF), SNF, SNSF, FNS

Funding Body Type
Private sector organisation

Funding Body Subtype
Trusts, charities, foundations (both public and private)

Location
Switzerland

Results and Publications

Individual participant data (IPD) sharing plan
The data sharing plans for the current study are unknown and will be made available at a later date.

IPD sharing plan summary
Data sharing statement to be made available at a later date

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes