UBSN
University Research Facility in Behavioral and Systems Neuroscience
神經科學中心實驗室

NEWSLETTER
ISSUE 09 (MAR 2024)

Dr. Yvonne HAN's tDCS and cognitive remediation training in adolescents and young adults with Autism

Researcher from Dr. Han's group, training with a participant

To date, there is no known cure for autism spectrum disorder (ASD). Although some behavioural interventions have shown positive therapeutic effects in reducing the outward problem behaviours associated with ASD, the disorder remains a highly disabling condition. Few treatment options are available for targeting core symptoms of ASD. The development of treatments that target common neural circuit dysfunctions is promising. Recently, a non-invasive brain stimulation technique, transcranial Direct Current Stimulation (tDCS), has shown great promise as a potentially effective and cost-effective tool for reducing core symptoms such as anxiety, aggression, impulsivity, and inattention in patients with autism.

A PolyU research team led by **Dr. Yvonne Han**, Associate Professor of the Department of Rehabilitation Sciences, is the first research team to conduct a series of double-blind randomised controlled trials (RCTs) to examine the clinical, neuropsychological, and neurophysiological effects of tDCS, alongside computerised cognitive remediation training, in adolescents and young adults with autism. This technique has been shown to modify behaviour by inducing changes in cortical excitability and enhancing information processing between the targeted brain areas.

To evaluate the clinical effects and neurophysiological processes of multisession prefrontal tDCS combined with cognitive remediation training, participants were randomly assigned to either active or sham-tDCS group. Participants were administered 1.5mA of prefrontal tDCS using the Starstim device from Neuroelectrics (cathode:F3, anode: FP2, size of electrodes: 25 cm^2) for 20 minutes per session over two consecutive weeks. tDCS was administered simultaneously with a computerized cognitive remediation training program. The sham tDCS group received identical cognitive remediation training and followed the same tDCS protocol as those in the active group, with the only difference being the absence of the 20-minute stimulation. Social functioning, information processing efficiency during cognitive tasks, and brain activities were measured using EEG before and after the treatment (Figure 1).

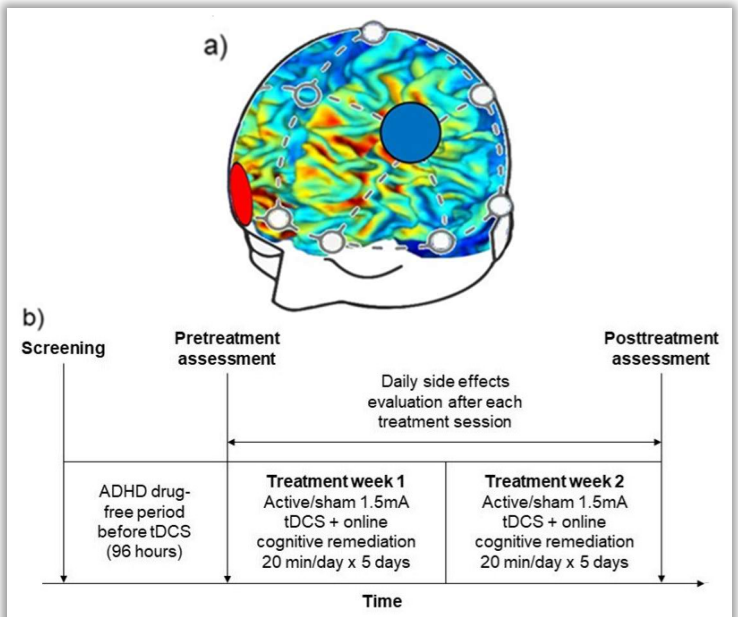


Figure 1:

Intervention protocol used in this study.

a) shows the electrode placement and the electric field modelling generated by 1.5mA tDCS with F3 (25cm^2 circular cathode) – Fp2 (25cm^2 circular anode) montage for 20 minutes.

b) shows the experimental design of this study.

Findings from this study indicated that, relative to sham tDCS, active tDCS was effective in enhancing overall social functioning and information processing efficiency during cognitive tasks in these individuals. Electroencephalography data showed that this tDCS protocol was effective in reducing the theta-band E/I ratio of the cortical midline structures and that this reduction significantly predicted information processing efficiency enhancement (Figure 2).

Study results support the use of multisession cathodal tDCS over the left dorsolateral prefrontal cortex combined with online cognitive remediation for reducing the elevated theta-band E/I ratio in sociocognitive information processing circuits in ASD patients, resulting in more adaptive regulation of global brain dynamics that is associated with enhanced information processing efficiency after the intervention.

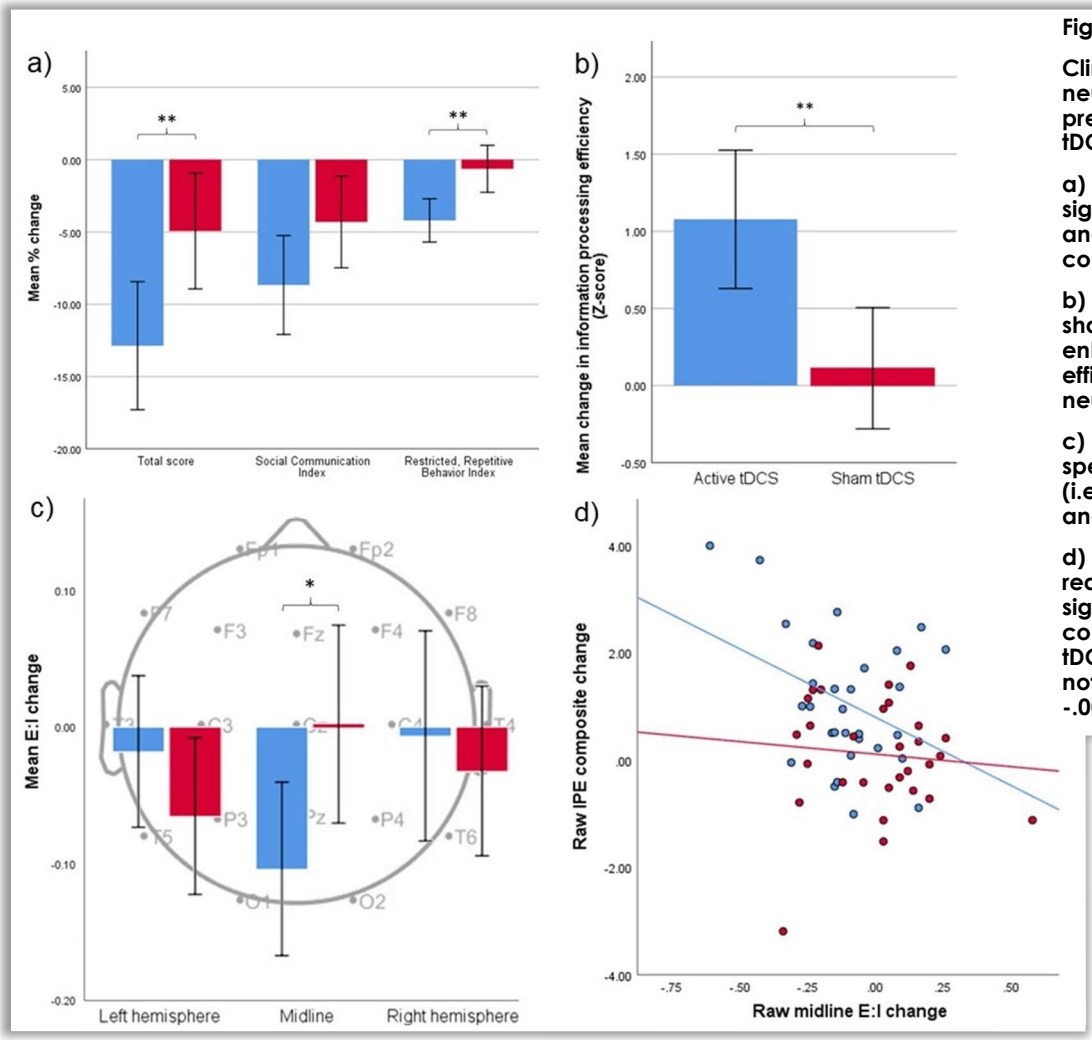


Figure 2:

Clinical, neuropsychological and neurophysiological effects of prefrontal tDCS in ASD (blue: active tDCS; red: sham tDCS).

a) shows that active tDCS significantly reduced SRS-2 total and RRB index scores when compared to sham tDCS (ps < .01).

b) shows that when compared to sham tDCS, active tDCS significantly enhanced information processing efficiency (p < .01). Regarding neurophysiological outcome,

c) shows that active tDCS specifically modulated midline E:I (i.e. averaged E:I values from Fz, Oz and Pz; p < .05).

d) is a scattered plot showing that reduction in midline E:I only significantly predicted IPE composite enhancement in active tDCS (R2 linear = -.141; p = .041), but not in the sham tDCS (R2 linear = -.008; p = .637) group.

Dr. Yvonne HAN

Associate Professor

Dept of Rehabilitation Sciences

These findings are published in the journal *Brain Stimulation* (DOI: 10.1016/j.brs.2023.10.012).
Trial registration: ClinicalTrials.gov (ID: NCT03814083)
Funding: General Research Fund (GRF15105322)*

Introducing UBSN's new animal equipment update

Behavioural test:

Tail Suspension Test

The **Tail Suspension Test** is a commonly employed test used for assessing depressive-like behaviour in rodents. By suspending the animal by its tail, this test measures immobility time as an indicator of despair-like behaviour. It aids in studying the efficacy of potential treatments and enhancing our comprehension of depressive disorders.

Specifications:

- 20cm(w) * 40cm(h) * 30cm(d)
- Designed as two sets of boards that assemble inside an open field box to form two partitions of the above dimensions.
- Can be used with ANY-maze tracking software

*A plastic model is used in this photo for demonstration purposes.

Behavioural test:

Forced Swim Test

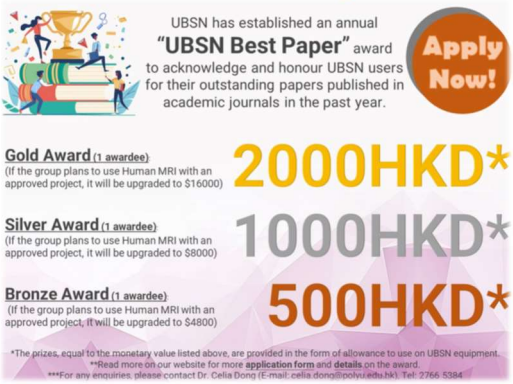
The **Forced Swim Test** is a widely used behavioural test, placing rodents in an unpleasant environment, assessing their depressive-like behaviour. This test provides valuable insights into the efficacy of potential antidepressant treatments and helps advance our understanding of mood disorders.

Specifications:

- 15cm(diameter) * 20cm(h)
- Acrylic cylinder
- Fits into our behavioural equipment bundle, and use our open field box arena as backdrop
- Can be used with ANY-maze tracking software

Officer-in-charge: Dr. Howard CHAN (howardhw.chan@polyu.edu.hk)
More information on UBSN equipment: https://www.polyu.edu.hk/ubsn/facilities/equipment/

"UBSN Best Paper" Award 2024 Is Now Open for Application!



We are pleased to establish an annual "UBSN Best Paper" Award to promote and advance the quality of neuroscience research conducted by UBSN PIs!

Submission deadline: **31 March 2024**

For eligibility, selection criteria, application form, result announcement date, and other information: https://www.polyu.edu.hk/ubsn/news-and-events/news/2024/ubsn-best-paper-award-is-now-open-for-application/

For any enquiries, please contact Dr. Celia Dong (E-mail: celia.dong@polyu.edu.hk), Tel: 2766 5384

Recent events at UBSN

In January, UBSN organised a workshop for the Multifocal Visual Evoked Cortical Potentials (VECP) System which measures Electroretinogram (ERG) in mice here at UBSN. We also welcomed student visitors from Zhejiang University!

Electroretinogram (ERG) Animal Neuroscience Workshop
Instructor: Gaush Meditech Ltd.

Visitors from Zhejiang University
University students

In February, UBSN warmly received Prof. YI Chung-Hwi and his colleagues from Yonsei University, South Korea.

Visitors from Yonsei University, South Korea
Visitor: Prof. YI Chung-Hwi & his colleagues

In March, Prof. Arturo HERNANDEZ from University of Houston, USA, visited UBSN! UBSN is also honoured to have Prof. Henry CHAN from School of Optometry sharing his research on Electroretinogram (ERG) with us. They also gave us a very in-depth lab demonstration at his lab!

Visitor from University of Houston, USA
Visitor: Prof. Arturo HERNANDEZ

Electroretinogram (ERG) Research Seminar
Speaker: Prof. Henry CHAN

Electroretinogram (ERG) Research Lab Demo
Instructor: Milan RAI (Prof. Henry CHAN group)

At UBSN, we hope to bring users useful knowledge regularly and inspire more innovative research at PolyU.
If you have any requests or suggestions on an equipment, please drop us a message!

For more UBSN news and events, visit our website: https://www.polyu.edu.hk/ubsn/news-and-events/

Upcoming Events at UBSN

Up next in April and May we will have two Capacity Building Scheme seminars.

A selected piece of UBSN equipment is featured every few months. This bimester featured "**ERG**" (Electroretinogram in Animal); Later this year, we will have seminars and workshops on **Human behaviour** equipment e.g. fNIRS, TMS, EEG, etc

We also have our first-ever **Open Day** on **4th of May 2024 (Sat)**.
Seminars, lab tours and souvenirs will be organised!

Stay tuned: https://www.polyu.edu.hk/ubsn/news-and-events/

Follow on Instagram:

@UBSN.POLYU

Have any questions? Interested in using our equipment? Please contact us!
Website: https://www.polyu.edu.hk/ubsn **E-mail: ubsn.enquiry@polyu.edu.hk**

University Research Facility in Behavioral and Systems Neuroscience (UBSN)

Open Day 2024

Date: **4th May 2024**
Time: **10:00 – 17:00**
Venue: **Block Z, PolyU**

- **2/F Podium (Exhibits)**
- **Rm Z211 (Seminars)**
- **Rm ZB216-218 (UBSN/ Lab tours)**

Program Highlights

- Seminars from Keynote Presenters
- Seminars from UBSN Principal Investigators
- Lab Tours (Introductions to various equipment: Human 3T MRI and Mock MRI, Human and Animal Electrophysiological and Behavioral equipment)
- UBSN Best Paper Award Ceremony
- UBSN Souvenirs (USB Flash Drive, Mug Set, Umbrella, Coaster, Travel Adaptor and more)

Register Now!

Keynote Speakers:

Prof. GAO Jia-Hong,
Professor and Director
Center for MRI Research, Peking University

Prof. Gao is an expert in the fields of functional and molecular magnetic resonance imaging and their applications in neuroscience and medicine.

Prof. QIU Anqi,
Professor, Global STEM Scholar
Department of Health Technology and Informatics, The Hong Kong Polytechnic University

Prof. Qiu is an expert in the fields of machine learning in medical images, medical image analysis, neuroimage, imaging genetics, brain development and aging, precision of psychiatric disorders.

Plenary Speakers:

Prof. SUN Lei,
Professor
Department of Biomedical Engineering, The Hong Kong Polytechnic University

Dr. Bolton CHAU,
ADoMHRC & Associate Professor
Department of Rehabilitation Sciences, The Hong Kong Polytechnic University

Dr. Yvonne HAN,
Associate Professor & Programme Leader of BSc (Hons) in Occupational Therapy
Department of Rehabilitation Sciences, The Hong Kong Polytechnic University

For enquiry, please contact
Dr. Patrick Yeung

patrick-kk.yeung@polyu.edu.hk
ubsn.enquiry@polyu.edu.hk

2766 7773

The Hong Kong Polytechnic University 香港理工大學

UBSN University Research Facility in Behavioral and Systems Neuroscience 神經科學中心實驗室

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