Transcranial electrical stimulation (TES)

- Impact of transcranial direct current stimulation combined with median nerve stimulation on CRS-R in patients with prolonged disorders of consciousness after cerebral hemorrhage: protocol for a randomized controlled trial
- Physical Modalities for the Treatment of Pain in Patients with Fibromyalgia
- Combined Transcranial Direct Current Stimulation and Functional Electrical Stimulation for Upper Limbs in Individuals with Stroke: A Systematic Review
- Feasibility and acceptability of combining cognitive remediation and tDCS in long-term psychiatric clinical care
- Modulation of Cortical and Hippocampal Functional MRI Connectivity Following Transcranial Alternating Current Stimulation in Mild Alzheimer Disease
- On the Causal Role of the Right Lateral Prefrontal Cortex in Active Forgetting
- Prefrontal cortex modulation using transcranial direct current stimulation in opioid craving: A sham-control double-blind study
- Preventing the transition from acute to chronic low back pain using home-based neuromodulation: protocol for a randomised, controlled study

Transcranial Electrical Stimulation (tES) is a non-invasive technique that applies mild electrical currents to the scalp to modulate neuronal activity in the brain. This method is used in both research and clinical settings to explore brain function and potentially treat various neurological and psychiatric conditions.

Types of Transcranial Electrical Stimulation

- **Transcranial Direct Current Stimulation (tDCS):**
  - **How it works:** Applies a constant, low-intensity direct current through electrodes placed on the scalp.
  - **Effects:** Can either increase (anodal stimulation) or decrease (cathodal stimulation) neuronal excitability.
  - **Applications:** Studied for enhancing cognitive functions, motor skills, and mood regulation.
- **Transcranial Alternating Current Stimulation (tACS):**
  - **How it works:** Delivers an alternating current that can synchronize with brain oscillations.
  - **Effects:** Aims to influence brain rhythms associated with specific cognitive or motor functions.
  - **Applications:** Explored for treating conditions like depression and epilepsy.
- **Transcranial Random Noise Stimulation (tRNS):**
  - **How it works:** Uses a random electrical noise pattern to stimulate the brain.
  - **Effects:** May enhance cortical excitability and neuroplasticity.
  - **Applications:** Investigated for improving learning processes and sensory perception.

Potential Benefits

- **Cognitive Enhancement:** Some studies suggest tES can improve memory, attention, and

problem-solving skills.
- **Motor Recovery:** Used in rehabilitation to aid recovery from stroke or motor impairments.
- **Mood Regulation:** Researched as a treatment for depression and anxiety disorders.
- **Chronic Pain Management:** Potential to reduce pain perception in conditions like fibromyalgia.

Safety and Side Effects

- **Common Side Effects:** Mild tingling, itching, or redness at the electrode sites.
- **Serious Risks:** Rare when used correctly, but misuse can lead to skin burns or unintended neural effects.
- **Contraindications:** Not recommended for individuals with implanted electronic devices (e.g., pacemakers) or certain neurological conditions without medical supervision.

Considerations

- **Efficacy Varies:** Results can differ based on individual factors like skull thickness, electrode placement, and stimulation parameters.
- **Professional Guidance:** Should be administered or supervised by trained professionals, especially for therapeutic purposes.
- **Regulatory Status:** Not all tES devices are approved for medical treatment; many are designated for research use.

Current Research and Outlook

While tES shows promise in various fields, more large-scale, controlled studies are needed to establish standardized protocols and confirm long-term efficacy and safety. Researchers are actively exploring how to optimize stimulation parameters and identify which populations may benefit the most.

Conclusion

Transcranial Electrical Stimulation is a versatile tool with potential applications ranging from cognitive enhancement to therapeutic interventions. If you're considering tES for personal use or treatment, it's essential to consult with a healthcare professional to understand the benefits, risks, and appropriate usage.

Transcranial electrical stimulation (tES) is one of the oldest and yet least understood forms of brain stimulation. The idea that a weak electrical stimulus, applied outside the head, can meaningfully affect neural activity is often regarded as mysterious. Here, we argue that the direct effects of tES are not so mysterious: Extensive data from a wide range of model systems show it has appreciable effects on the activity of individual neurons. Instead, the real mysteries are how tES interacts with the brain's own activity and how these dynamics can be controlled to produce desirable therapeutic effects. These are challenging problems, akin to repairing a complex machine while it is running, but they are not unique to tES or even neuroscience. Krause et al. suggest that models of coupled

oscillators, a common tool for studying interactions in other fields, may provide valuable insights. By combining these tools with our growing, interdisciplinary knowledge of brain dynamics, we are now in a good position to make progress in this area and meet the high demand for effective neuromodulation in neuroscience and psychiatry [1].

1)

Krause MR, Vieira PG, Pack CC. Transcranial electrical stimulation: How can a simple conductor orchestrate complex brain activity? PLoS Biol. 2023 Jan 30;21(1):e3001973. doi: 10.1371/journal.pbio.3001973. PMID: 36716309.