Transcranial alternating current stimulation for epilepsy

Transcranial Alternating Current Stimulation (tACS) is a promising noninvasive electrical stimulation therapy for neuropsychiatric disorders. Invasive neuromodulation using alternating current has been efficacious for drug-resistant epilepsy, but it is associated with surgical and medical complications. San-Juan et a. aimed to explore the safeness and effectivity on seizure frequency reduction of two tACS protocols against placebo in patients with multifocal refractory epilepsy. This was a randomized, double-blinded, placebo-controlled clinical trial with 3-arm parallel-group (placebo, 30 min/2 mA daily sessions for 3 days [tACS-30], and 60 min/2 mA weekday sessions [tACS-60]). The main outcome was considered a change in reducing seizure frequency at 2 months after the intervention. Secondary outcomes were the apparition of any adverse effects during follow-up. At the second month, we observed a nonsignificant reduction in the seizure frequency in the placebo (7.3 ± 40.4%, $p > 0.05$) and the tACS-60 (26 ± 37.7%, $p > 0.05$). While the tACS-30 group showed a nonsignificant increase in seizure frequency (63.6 ± 155.3%, $p > 0.05$). No changes were statistically different from the placebo group. Otherwise, participants experienced only minor adverse events - the most common being an initial local transient tingling sensation (21%). This pilot study of tACS raises no severe safety issues but provides negligible evidence for efficacy using this brief treatment protocol. Therefore, more studies are warranted to test different parameters to further verify the safety and effectivity of tACS in multifocal epilepsy [1].

Case series

Seven patients with pharmacoresistant ES were included, receiving a total of eighteen 14-day blocks of tDCS treatment. We observed a significant difference in seizure frequency at the second month ($p = 0.028$, unadjusted), as well as a trend toward decreased seizure frequency at the fourth month ($p = 0.068$, unadjusted) of the first follow-up, relative to baseline. Three of seven patients (42.9%) exhibited sustained seizure reduction, while one (14.3%) experienced a short-term reduction in seizure frequency following cathodal tDCS treatment. Treatment was well tolerated in all patients. Conclusions: Repeated tDCS with the cathode placed over the bilateral parietal region is safe and may be effective for reducing seizure frequency in a subgroup of patients with pharmacoresistant ES [2].

Case reports

A 16-year-old female with pharmaco-resistant juvenile myoclonic epilepsy to 3 antiepileptic drugs characterized by 4 myoclonic and 20 absence seizures monthly. She received tACS at 1 mA at a 3 Hz pulse train during 60 min over Fp1-Fp2 (10-20 EEG international system position) for 4 consecutive days using an Endeavor™ IOM Systems device® (Natus Medical Incorporated, Middleton, WI, USA). At the 1-month follow-up, she reported a 75% increase in seizures frequency (only myoclonic and tonic-clonic events) and developed a 24-h myoclonic status epilepticus that resolved with oral clonazepam and intravenous valproate. At the 2-month follow-up, the patient reported a 15-day seizure-free period [3].

1)
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