Skin Burns From Transcranial Electrical Stimulation

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PRACTICE **POINT**

- Cranial skin burns can point to misuse of electrical stimulation.

To the Editor:

In recent years, noninvasive brain stimulation techniques have gained growing importance in the treatment of psychiatric[1] and neurologic disorders as well as in neurologic rehabilitation (eg, after a stroke).[2] One of these techniques is transcranial electrical stimulation (tES), which includes transcranial direct current stimulation (tDCS), transcranial random noise stimulation, and transcranial alternating current stimulation. The current is administered through rubber electrodes covered by saline-soaked sponges that are attached to the skull over the dysfunctional brain areas using broad rubber bands.

Transcranial direct current stimulation ameliorates brain function by anodal stimulation after a series of 5 to 10 stimulations.[1] Recently, commercially available brain stimulation devices have been developed to improve working memory for online/video gaming[3]; however, application of a direct current (eg, 1–2 mA) over longer periods of time (15–20 minutes) can cause skin burns due to drying out of the electrode.[4] Inhomogeneities in skin-electrode contact can lead to current bridges, resulting in quick evaporation of the contact medium (sodium chloride solution) and subsequent thermic damage of the skin. Another possible cause of skin lesions associated with tES is skin contact with the rubber electrode due to incorrect positioning of the electrode in the sponge covering. We report 2 cases of burns caused by tDCS.

A 55-year-old woman who was treated with tDCS (2 mA; 20 minutes) for recurrent depressive disorder developed a 0.5-cm, round, erosive, second-degree burn with hemorrhagic crust on the skin in the middle of the area where a 5×7-cm electrode (cathode) was positioned over the right orbit (Figure 1). It was the fifth stimulation with tDCS. The anode was positioned over the left dorsolateral prefrontal cortex. It was determined that the saline-soaked sponge covering the rubber electrode dried out during treatment and caused the burn. Transcranial

FIGURE 1. Round, 0.5-cm, erosive burn with hemorrhagic crust in the middle of the area where a 5×7-cm electrode (cathode) was positioned on the skin over the right orbit.

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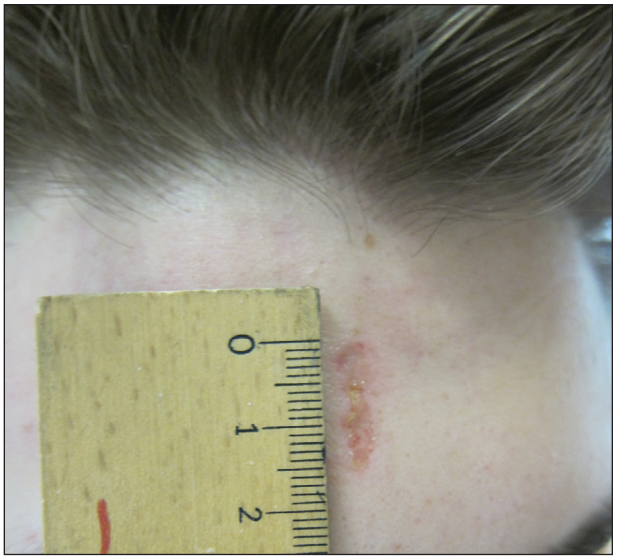

FIGURE 2. Stripe-shaped, 1.5-cm burn caused by skin contact from a 5×7-cm rubber electrode that was not fully covered by the saline-soaked sponge.

direct current stimulation subsequently was stopped, and the lesion healed without intervention within 4 to 5 weeks, resulting in a small scar.

A 20-year-old man who was treated with tDCS (2 mA; 20 minutes) for schizophrenia developed a superficial stripe-shaped burn on the skin over the right orbit after the eighth stimulation because the 5×7-cm rubber electrode (cathode) was not fully covered by the saline-soaked sponge and the skin came into direct contact with the short side of the electrode (Figure 2). Transcranial direct current stimulation was stopped, and the skin lesion healed without intervention within 4 to 5 weeks with no scar.

The main factor associated with thermic skin damage in tES is incorrect application of the electrodes; therefore, a high standard should be applied when soaking sponges and placing and fixing the electrodes but likely is only guaranteed in specialized services and not when utilizing tES at home. Dermatologists may be confronted with an increasing number of burns due to the widespread use of tES for modulating neuropsychiatric disorders but also due to the use of tES as a lifestyle brain tuning instrument.[3]

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