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Response to "A comment on postural stability improvement in older adults with high fall risk after anodal tDCS on primary motor cortex versus cerebellar stimulation"

Dear Editor,

We appreciated Kang & Cauraugh's letter ('A Comment on Postural Stability Improvement in Older Adults with High Fall Risk after Anodal tDCS on Primary Motor Cortex versus Cerebellar Stimulation') in response to our research article [[1]].

Kang & Cauraugh's primary point – the insufficient focal administration of the unilateral anodal tDCS on the dominant M1– is well taken, especially given the increasing recognition of this insufficiency when we use the traditional large electrodes (i.e., 5×7 cm^2) targeting a focal site (i.e. C3) over cortex [2,3]. Therefore, in agreement with the suggestion of Kang & Cauraugh's letter, we also believe that the findings in our study and in any other studies using traditional large electrodes should be interpreted with caution. Indeed, any interpretation should also consider this lack of stimulation focality and consider the impact of stimulation on nearby sites around the target area. These sites which may have excitatory or inhibitory effects, may functionally be connected to the target area. Therefore, the total effect is combination of the effects on the target area and these nearby brain sites [2].

Kang & Cauraugh recommended the use of high-definition tDCS (HD tDCS) [4] to address the issues related to the focality of tDCS applications. This is a good solution but we should make sure to address the potential deleterious issues related to HD tDCS first. This technique (1×4 montage) is based on the assumption that the center electrode is the active electrode and the four surround electrodes (return electrodes) are not contributing to the modulation of the underlying brain areas. We believe that this assumption is not entirely true. For example, during application of 2 mA anodal-tDCS, each surround electrode applies 0.5 mA cathodal tDCS. It should be noted that current intensities as low as 0.3 mA are also having modulatory effects on brain [5]. Indeed, in this montage we have anodal tDCS of the target area at the center and cathodal tDCS of the surrounding sites. Therefore, the total effect is a combination of the effects under both center and surround electrodes. Sometimes these surround sites are functionally connected to the central site and depending on their effects (excitatory/inhibitory), they may contrarily contribute in modulation of the targeted brain site under the center electrode.

Kang & Cauraugh also recommended bilateral M1 stimulation in future balance studies to assess the contribution of cerebral motor regions for postural control needs. Considering the fact that "balance" is a bilateral task and involves the muscles in both upper and lower limbs and also trunk muscles in both sides of the body, bilateral M1 stimulation is a logically sound suggestion for future studies.

In summary, we strongly agree with Kang & Cauraugh's recommendations on the focality of tDCS administrations and also believe that future studies are required to shed light on the contribution of cerebral regions on balance and postural control.

Conflicts of interest

The authors declare that there is no conflict of interest.

Disclosure statement

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