The effects of transcranial direct current stimulation of dorsolateral prefrontal cortex over multiple days on shooting performance in elite Deaflympic athletes: A case series

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ABSTRACT

Transcranial direct-current stimulation (tDCS) is a non-invasive brain stimulation method that has shown the ability to enhance motor learning in numerous studies. However, only a few of these studies have been conducted on elite level performers or in complex motor tasks that have been practiced extensively. Rifle shooting is a difficult motor task that has real-world implications in military, police, and sport settings. Although a few studies have investigated the influence of tDCS on shooting performance, these were all acute studies conducted on novice performers. The **PURPOSE** was to determine the effects of DLPFC-tDCS on motor learning over multiple days on 10-meter air rifle shooting performance in elite Deaflympic athletes. **METHODS**: Two male and 2 female elite Deaflympic athletes (e.g., European and National medalists) participated in the study. In a randomized, double-blind, SHAM-controlled, cross-over design, participants received 3 days of either DLPFC-tDCS or SHAM stimulation 1 week apart. Anodal tDCS was applied to the left DLPFC for 25 minutes with a current strength 2 mA concurrent with their standard shooting practice regiment. SHAM stimulation was applied according to standard SHAM protocols. A total of 7 trial blocks (10 shots per block) were performed each day and consisted of a pre-test block, 3 practice blocks with stimulation, and 3 post-test blocks without stimulation. An automated electronic scoring and target system used for sport shooting quantified the shot placement and shooting score. **RESULTS**: A 2 *Condition* x 3 *Day* within-subjects ANOVA revealed no significant main effects or interaction (*P* value range: 0.393-0.774). Due to the limitations of using statistical tests yielding *P* values for case series data, analyses involving improvement over time and historical control comparisons were undertaken, but revealed no discernable DLPFC-tDCS performance effects. **CONCLUSION**: The results indicate that DLPFC-tDCS applied for 3 consecutive days does not improve shooting performance in elite athletes. The findings are similar to a few previous studies that involved tDCS of motor cortex in other motor tasks in elite performers. Therefore, different stimulation parameters or long-term (weeks/months) application of tDCS may be needed to improve performance in elite populations.