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Sommario/riassunto

Brain stimulation techniques, transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (TDCS), modify brain function through interaction with multiple neurotransmitters and networks. The implementation of these non-invasive stimulation techniques in physiology, behavioral studies, with modelling or functional imaging has provided an outstanding causal link between brain structure and function and helped identify neural networks mediating cognitive or motor function. The potential efficacy of non-invasive brain stimulation procedures for the management of specific symptoms in diverse neurological and psychiatric conditions has been tested in the past decade or so. For example, repetitive TMS over prefrontal areas has been extensively investigated as a treatment for patients with medication-resistant depression and has been shown to be associated with improvement of mood. Similarly, non-invasive stimulation techniques have been applied to various symptoms of Parkinson's disease such as bradykinesia and dyskinesias, with variables degrees of success reported. However, attempts to expand previously observed clinical improvements to other neurological disorders (e.g. Tourette's syndrome, autism, epilepsy) has been controversial. In trying to bypass potential confounding elements, researchers aim to target neural populations altered in disease to either increase or decrease their corrupted baseline activity. In addition, a complementary approach is to extend stimulation protocols that results

enhanced behavior in healthy participants. One of the potential limitation of this latter strategy has been that most of the protocols evaluated in healthy participants have been tested in populations that are not comparable to the patient populations. This Frontiers Research Topic on non-invasive brain stimulation and enhancement of function seeks to combine contributions from researchers who found non-invasive brain stimulation induced improvement of either a motoric, cognitive or behavioral nature investigated behaviorally, physiologically or using brain imaging techniques in clinical populations. Investigation of the relation between enhancement of function in healthy populations and improvement of symptoms in patients with neurological or psychiatric disorders needs further consideration. Critically, the topic will be centered on the following topics to expand current knowledge: • selection of adequate stimulation protocols, including simple questions such as whether TMS or TDCS is more efficacious for inducing enhancement of function in brain disease; • methodological issues such as optimizing cortical targets and the use of good control groups; • which symptoms to tackle in different brain disorders. For example, is it possible to de-activate hyperactive cortical regions present in Parkinson disease to induce clinical amelioration? Do protocols used in healthy populations produce similar predictable effects in parkinsonian persons?; • potential of using stimulation protocols in combination with pharmacological or cognitive therapy; • the use of appropriate clinical, behavioral, physiological and imaging tools to measure brain plastic changes. Consideration about possible multi-centre clinical trials: feasibility, problems and authorization pathways. Studies or reviews on cost-effectiveness. The aim of this topic is to determine which disease signs are treatable with non-invasive brain stimulation and available protocols to interfere with altered brain systems and produce enhanced motor and behavior outcomes. This Frontiers Research Topic will be important in identifying new avenues of clinical research for rapid advances in the field.