

Effects of 400 Hz Transcranial Pulsed Current Stimulation on Corticospinal and Corticocortical Excitability and Hand Dexterity: A Double-Blind RCT

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Abstract

The effects of 400 Hz anodal and cathodal transcranial pulsed current stimulation of the primary motor cortex (400 Hz a-tPCS_{M1}, 400 Hz c-tPCS_{M1}) on corticospinal excitability (CSE) and corticocortical excitability (CCE) remain underexplored. This study examined the effects of 400 Hz a-tPCS_{M1}, 400 Hz c-tPCS_{M1}, and sham stimulation on CSE, CCE, and hand dexterity, providing insights for potential clinical applications in motor deficits. In this double-blinded, randomized, counterbalanced crossover trial, 26 healthy young adults completed three experimental sessions: 400 Hz a-tPCS_{M1}, 400 Hz c-tPCS_{M1}, and sham stimulation, spaced 48 hours apart. Transcranial magnetic stimulation assessed CSE and CCE, while the Purdue Pegboard Test (PPT) evaluated hand dexterity. The results showed polarity-specific effects. A single session of 400 Hz a-tPCS_{M1} significantly increased CSE and improved hand dexterity, evidenced by faster PPT completion times ($p < 0.05$). Conversely, 400 Hz c-tPCS_{M1} reduced CSE but did not influence PPT performance ($p > 0.05$). Sham stimulation showed no significant changes. These findings suggest that 400 Hz a-tPCS_{M1} enhances motor excitability and dexterity, while 400 Hz c-tPCS_{M1} selectively reduces CSE. This study lays a foundation for exploring high-frequency tPCS in clinical motor rehabilitation.

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