

[2P]Neural Circuit Manipulation

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***Videos are available throughout the meeting period.**

[2P-267]Simulation Study for the magnetic field distribution produced by the brand-new transcranial static magnetic stimulation with three magnets

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Transcranial static magnetic stimulation (tSMS) is a new type of non-invasive brain stimulation. Using static magnetic fields produced by a single small high-powered neodymium, iron, and boron (NdFeB) magnet placed on the scalp, tSMS can reduce the cortical excitability below the magnet. Unlike other non-invasive brain stimulation methods associated with induced electric currents such as repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS), tSMS has no risk of seizures or tingling sensations. Thus, tSMS may be a promising neuromodulatory technique with safety and low cost.

The disadvantage of tSMS is the limitation of stimulation targets. Since the magnetic field produced by tSMS decreases with the distance from the magnet, the magnetic field strength is attenuated to non-effective level in deep brain areas. Overcoming this disadvantage can expand the possibility of its clinical use.

We developed a brand-new tSMS system with three magnets disposed in contiguity with each other. The system would produce an effective level of the magnetic field strength in deep brain areas by summing up the magnetic field produced by each magnet. We simulated the spatial distribution of the magnetic field produced by the brand-new tSMS in a simple sphere head model to verify its effectiveness.

The simulation was conducted in COMSOL (COMSOL, Inc., Burlington, MA, USA). A simple sphere with radius of 100 mm was used as a head model. Along the central axis of the system, a peak magnitude of 175 mT was observed at a distance of 17 mm from the surface of the sphere. At distances up to 76 mm from the surface of the sphere the magnetic field strength was >40 mT, which is reported to be sufficient for producing physiological effects.

This simulation study showed the brand-new tSMS with three magnets can produce an effective magnetic field in deep brain areas. The brand-new tSMS system can expand the possibility of the clinical use of tSMS.