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Deep transcranial magnetic stimulation for the treatment of neurological disorders

Transcranial Magnetic Stimulation (TMS) is a non-invasive, surgery free and safe neuro-modulation technique that uses time varying magnetic fields to alter the functions of a targeted brain region. TMS has been FDA approved for the treatment of major depressive disorder by stimulating the left dorso-lateral pre-frontal. Many neurological disorders such as Parkinson's disease, Post-Traumatic Stress Disorder originate from the deeper parts of the brain. With increase in median age of the population, the prevalence of neurodegenerative diseases is becoming common. In order to treat these disorders non-invasively, deep TMS is critically needed. Magnetic field generated from the TMS coil decays rapidly with distance from the surface of the coil. This makes it challenging to apply stronger magnetic fields at deeper regions of the brain. We have developed novel family of coil configurations called the "Halo Coil" and "Triple Halo Coil" which increase the fields in the deeper regions of the brain by reducing the decay rate from the field coil placed on top of the head. The first generation "Halo Coil" can induce a field of 3 times higher at 10 cm depth than the single circular coil. The second generation "Triple Halo Coil" can generate a field of 12 times higher than the circular coil at a depth of 15 cm. We have used an anatomically realistic head model considering different electrical and magnetic properties of tissues for the determination of electric and magnetic fields inside the brain. We have verified our calculation by magnetic field measurements around the TMS coils.

Biography

David C. Jiles has worked on magnetics for 35 years, authored more than 600 scientific papers, have published three books, and hold 19 patents. He has served as Editor-in-Chief of IEEE Transactions on Magnetics since 2005-2012. His research interests are in applications of magnetics including biomedical applications. His lab has developed new coil configurations called the "Halo Coil" that can stimulate deeper regions with low focality or cortical regions with high focality. He is a Fellow of Royal Academy of Engineering, Institute of Electrical and Electronics Engineers, the American Physical Society, the Institute of Physics and the Institute of Materials.

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