Transcranial magnetic stimulation (TMS) device with controllable pulse shape

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Technology description

Summary

Electromagnetic brain stimulation has emerged as a potential treatment for psychiatric and neurological disease. Using transcranial magnetic stimulation (TMS), pulses of electromagnetic energy can be delivered to specific targets within the brain, thereby either stimulating or inactivating local function, depending on the pulse sequence. This selective modulation of local brain activity can be vastly useful in treating various neurological or psychiatric diseases such as epilepsy and depression. During TMS delivery, the shape and sequence of electromagnetic pulses are integral towards achieving the desired modulation of neural activity. Thus, specialized electronic devices are needed in order to correctly and accurately deliver the desired TMS sequence to enhance patient care and research efficacy.

Advanced TMS technology allows finer control of pulse shape

The technology demonstrates a device for TMS that allows continuous control of the pulse width and shape of the induced current. The induced current in this device can be set to a rectangular shape in order to allow unipolar pulse trains to be delivered at high frequency, delivering higher energy to the tissue. Finally, polarity of the pulses can also be continuously adjusted, allowing unique sequencing of activation and deactivation signals. These advances in TMS technology allow for much finer control over the pulse applied. In order to achieve maximum effectiveness, TMS pulses require a high degree of wave-form precision. These alterations are appealing, as they reduce energy requirements and allow for continuous control of the TMS pulse, as well as the use of high frequency trains. In turn, this technology can stimulate and inhibit brain regions with higher levels of intensity and specificity as compared to traditional TMS technology.

Publications

Peterchev AV, Jalinous R, Lisanby. SH: A novel transcranial magnetic stimulator inducing near rectangular pulses with controllable pulse width (cTMS). IEEE Trans Biomed Eng 2008 Jan;55(1):257-66.

Application area

Treatment of depression, bipolar disorder and schizophrenia
Direct inactivation of epileptic areas in epilepsy
Treatment of Parkinson's symptoms without requiring device implantation
Research device for use in neurological and psychiatric research
Able to inactivate or stimulate specific brain regions at varying levels of intensity

Advantages

Continuous control of TMS pulse width and shape
Higher energy delivery allowing stronger and deeper neuromodulation
Energy efficiency allows high frequency pulse trains

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