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ON THE uptake

NON-INVASIVE BRAIN STIMULATION IN CEREBRAL PALSY

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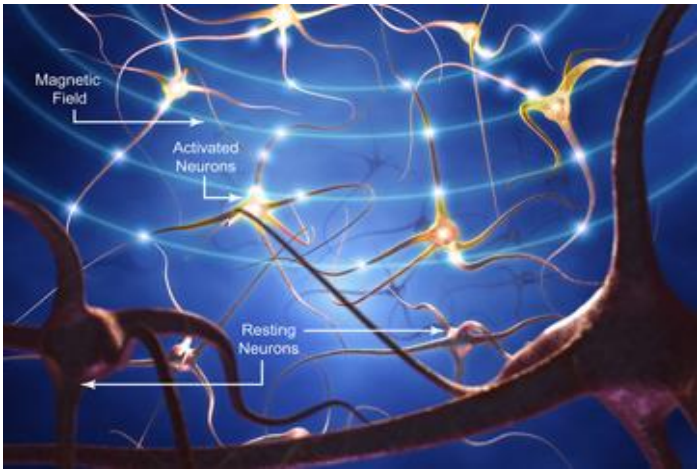
What is Non-Invasive Brain Stimulation and TMS?

- **Non-Invasive Brain Stimulation** refers to technologies using magnetic and electrical fields that can be safely and painlessly applied to a person's brain when he or she is awake.
- **TMS** stands for **T**ranscranial **M**agnetic **S**timulation. It is the most common form of non-invasive brain stimulation.
- During TMS, a focused magnetic field is delivered by a coil placed over the head. The field enters a small area of the brain and activates the cells (neurons). When applied over the movement (motor) parts of the brain, this can create a "twitch" in a muscle, which we can measure by placing stickers over that muscle.

Why use Non-Invasive Brain Stimulation in Children with Cerebral Palsy (CP)?

Brain stimulation has two primary applications in children with CP:

1. TMS can measure brain functions in many ways. These include determining the presence of certain pathways, how active or "excitable" the brain is, and how different areas of the brain are working with each other. TMS methods include giving one (single-



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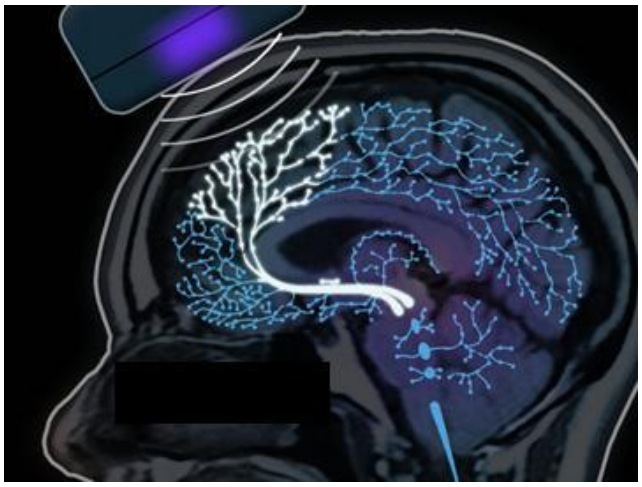


pulse) or multiple (paired-pulse) stimulations to measure different functions within the brain.

Measuring such functions in the brains of children is helpful to understand how the developing brain changes (called "plasticity") after an injury or a treatment.

2. The second ***potential*** application of brain stimulation is to treat brain disorders and improve brain function.

Can TMS treat my child's CP?

The answer to this question is not yet known. There has been almost no research to date on brain stimulation treatments in children.

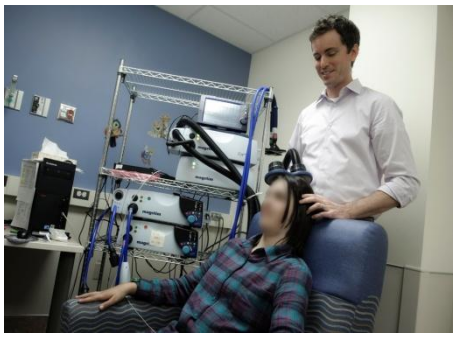
Early evidence from adult studies suggests that repetitive TMS (rTMS) ***may*** be able to alter brain function. Studies in adults who have a number of different neurological conditions support this possibility, although brain stimulation is still not in regular use in adults. For example, multiple small studies of adults with motor problems following a stroke suggest brain stimulation might enhance their function.

Other types of brain stimulation (e.g. Transcranial Direct Current Stimulation) may have similar potential. Evidence of the benefits of rTMS in children has not yet been established. We conducted a small, preliminary study in children with stroke that suggested rTMS might help motor function but additional studies are required. In addition, we are currently conducting a clinical trial to see if rTMS and rehabilitation can enhance motor function in children with hemiplegic (one-sided) CP caused by perinatal stroke. To learn more about this study, please go to this website: http://www.clinicaltrials.gov/ct2/show/NCT01189058

Is TMS safe in children? What does it feel like?

TMS is very safe and well tolerated in children. TMS therapy involves sitting still in a comfortable chair while the neurologist rests the coil over the area of the brain to be stimulated (see picture below). Different strengths of stimulation are applied and with stronger ones the muscles of the hand or face may twitch, but this is not painful. The only common complaint from young people is boredom as some studies take a few hours.

This is usually overcome by teaching kids about TMS and their brains, and



also by providing a flat screen TV where they can watch movies.

Helpful Links

Read more about TMS:

Guidelines:

Rossi S, Hallett M, Rossini PM, Pascual-Leone A, Safety of TMS Consensus Group. Safety, ethical considerations, and application guidelines for the use of transcranial magnetic stimulation in clinical practice and research. Clinical Neurophysiology, 2009 Dec;120(12):2008-39. http://www.sciencedirect.com/science/article/pii/S1388245709005197

Safety:

Gilbert DL, Garvey MA, Bansal AS, Lipps T, Zhang J, Wassermann EM. Should transcranial magnetic stimulation research in children be considered minimal risk? Clinical Neurophysiology, 2004 Aug;115(8):1730-9. http://www.sciencedirect.com/science/article/pii/S1388245704001968

Review article:

Frye RE, Rotenberg A, Ousley M, Pascual-Leone A. Transcranial magnetic stimulation in child neurology: current and future directions. Journal of Child Neurology, 2008 Jan;23(1):79-96. http://jcn.sagepub.com/content/23/1/79.long

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