

Transcranial Magnetic Stimulation

Introduction

1. Transcranial Magnetic Stimulation (TMS) is a non-invasive procedure which uses electromagnetic pulses produced by an insulated coil placed over the scalp to modulate the activity of the nervous system. When TMS is applied to the brain, modulation of activity in the brain cortex can influence certain brain functions and help to treat mental disorders. Repetitive TMS (rTMS), in which trains of electromagnetic pulses are delivered to the brain, is proven to be effective and safe for the treatment of a variety of mental disorders, such as Major Depressive Disorder and Obsessive Compulsive Disorder in adult patients.
2. The frequency and number of treatment sessions for a course of rTMS varies, depending on the clinical diagnosis, the choice of treatment protocol and other factors. The patient is fully awake during the treatment session. No general anaesthesia or sedation is required.

Contraindications

1. Implanted conductive, ferromagnetic, or other magnetic-sensitive metals in the head or within 30cm of the electromagnetic coil application site.
2. Implanted stimulator devices in or near the head.

Special note: Careful evaluation of the risk / benefit ratio is indicated for pregnant women, patients with cerebral pathology, and patients with pre-existing medical or neurological conditions that raise the risk of seizure.

The Procedure

1. All metal or magnetized objects which might interfere with magnetic field must be removed.
2. Before the treatment session, the TMS therapist will measure the motor threshold (MT) of the patient. The MT is the minimum energy level of the electromagnetic pulses delivered to the brain to bring about twitching of hand muscle. If necessary, MT measurement will be repeated during the course of treatment.
3. During the treatment session, trains of electromagnetic pulses are delivered to the brain through the electromagnetic coil placed over the target stimulation site. Besides hearing a clicking sound, the patient will experience tapping sensation over the stimulation site.

4. The TMS therapist will stay with the patient throughout the treatment session. In case any problem arises, the treatment will be terminated. The patient can also request to stop the treatment at any time.

Risks and Complications^{1,2,3}

1. Common:

- Tapping or painful sensations around the stimulation site, toothache and headache may be experienced during the treatment. Muscle contractions around the stimulation site may occur. The patient should inform the TMS therapist if the sensation is painful. The stimulation intensity or the location of the electromagnetic coil can be adjusted to alleviate the pain. The discomfort or pain will usually get better over time. Pain killer may help to reduce the discomfort or pain.

2. Uncommon / rare:

- Temporary hearing impairment and tinnitus may occur after treatment. These are caused by the loud clicking sound produced by the electromagnetic coil. The risk is minimized by wearing hearing protection devices during the treatment.
- Seizures have been reported with TMS. However, the risk of having a seizure is exceedingly low. The current estimated risk of seizure is 0.31 per 10,000 sessions, and 0.71 per 1,000 patients.
- During the treatment for Major Depressive Disorder, changes in mood state may occur. Any signs or symptoms of worsening depression, unusual behaviour or thoughts, emergence of manic features, or increase in suicidality should be immediately reported to the TMS therapist or doctor. The TMS therapist will monitor the patient's mental condition throughout the treatment session.

Remarks

1. The patient can withdraw his / her consent at any time. If the patient withdraws the consent, his / her right to continue receiving other treatment alternatives in his / her best interest will not be affected.
2. Treatment response varies between individuals. Alternative treatment options, such as medications, psychotherapy or electro-convulsive therapy (ECT), could also be considered.
3. This leaflet is for general information only and the list of risks and complications is not exhaustive. The actual risks may vary between individuals. The patient could contact his / her doctor for further information.

- ¹ Rossi S, Hallett M, Rossini PM, Pascual-Leone A, and the Safety of TMS Consensus Group. Safety, ethical considerations, and application guidelines for the use of transcranial magnetic stimulation in clinical practice and research. *Clin Neurophysiol.* 2009 Dec; 120(12): 2008-39.
- ² Rossi S, Antal A, Bestmann S, Bikson M, Brewer C, Brockmüller J et. al.. Safety and recommendations for TMS use in healthy subjects and patient populations, with updates on training, ethical and regulatory issues: Expert Guidelines. *Clin Neurophysiol.* 2021 Jan; 132(1): 269–306.
- ³ Taylor JJ, Newberger NG, Stern AP, Phillips A, Feifel D, Betensky RA, Press DZ. Seizure risk with repetitive TMS: Survey results from over a half-million treatment sessions. *Brain Stimul.* 2021 Jul-Aug; 14(4): 965-973.