# Transcranial Magnetic Stimulation (TMS) Fact Sheet

**Bottom Line:**
TMS is a reasonable option for patients who have failed several antidepressant trials and who are willing to commit to daily clinic visits for up to six weeks.

**FDA Indications:**
**Depression that has not responded to one prior medication trial; OCD;** migraine pain.

**Off-Label Uses:**
Post-stroke depression; Parkinson's disease; Alzheimer's disease; PTSD; chronic pain.

**Procedure:**
- There are several FDA-cleared TMS devices, and they all include magnetic coils, controller equipment, and a comfortable adjustable seat.
- Parameters of treatment include frequency (number of pulses per second, or hertz, typically 10–20), intensity (usually expressed as percentage of motor threshold—the threshold being the intensity of magnetic field required to elicit a motor response), train duration (how many seconds of pulsing occurs, typically four seconds), inter-train interval (time between trains, typically 26 seconds), and number of trains per session (eg, 80, assuming two trains per minute).
- During the first session, the optimal spot for stimulation is chosen by positioning the coil to elicit a motor twitch in the hand; the coil is then shifted 5 cm forward from that area.
- The standard protocol is high frequency, which is 10 hertz, or 10 pulses per second.

**Pre-TMS Workup:** No specific labs are required. Contraindicated in patients with increased risk for seizure or with implanted metallic hardware (such as pacemakers, cochlear implants, or aneurysm clips). All patients should have a standard history and physical prior to TMS.

**Cost:** $$$; insurance companies will often pay for the procedure if you can document several prior antidepressant treatment trials and failures.

**Side Effects:**
- Most common: Scalp discomfort, especially with high-frequency TMS, described by some patients as feeling like a woodpecker tapping on their head.
- Serious but rare: Instances of grand mal seizures and hearing loss.
- Pregnancy/breastfeeding: Can be safely administered during pregnancy and lactation.

**Mechanism, Treatment Course, and Drug Interactions:**
- TMS produces a magnetic field that modulates the activity of neurons in the cortical brain regions targeted by the coil. Theoretically, the left dorsolateral prefrontal cortex is underactive in depression, and high-frequency TMS (10 hertz) increases that activity. Low-frequency TMS (1 hertz) *inhibits* cortical activity, so it is administered over the right dorsolateral prefrontal cortex.
- Treatments are given five days a week; sessions are 30–40 minutes, and response usually begins after about 20 treatments (four weeks). Average number of treatments is about 30, or a six-week course. There is usually a three-week taper-down phase decreasing to three treatments in week one, two treatments in week two, and one treatment in week three. Some clinics do maintenance treatments of one or two treatments per month.
- TMS can be administered by trained non-MD staff. There is no requirement that the psychiatrist see patients during each appointment, and it's common for a trained operator to administer the daily treatments while the psychiatrist sees the patient once a week.
- In most naturalistic open-label studies, response rates have been in the range of 60%.
- Long-term response: About 60% of patients maintain a response at 12 months (Dunner DL et al, *J Clin Psychiatry* 2014;75(12):1394–1401).
- Medications and TMS: All psychiatric medications may be continued during TMS, but the treatment may work better for patients who can discontinue benzodiazepines or anticonvulsants.

**Clinical Pearls:**
- In deciding between ECT and TMS, consider that ECT works faster and is the device of choice for suicidal or psychotic depression. Patients may like the fact that TMS has fewer side effects and does not require anesthesia.
- The most commonly used form of TMS is repetitive TMS (rTMS), which stimulates the surface cortex. Deep TMS (dTMS) stimulates deeper regions. Express TMS is a rapid form of TMS for depression that reduces treatment time from 20–38 minutes to three minutes using a high-intensity magnet that produces something called intermittent theta burst stimulation (iTBS).
- The first TMS devices were approved by the FDA in October 2008.

**Fun Fact:**
The book *3,000 Pulses Later* describes advertising executive Martha Rhodes' positive experiences with TMS, which she credits with treating her refractory depression. "3,000 pulses" refers to the typical number of pulses delivered during a single TMS session.