The Differences Between Deep TMS and Repetitive TMS, A Layman's Guide

Many people with depression often suffer for long periods of time before finding a cure that works; this is referred to as drug-resistant depression. Transcranial magnetic stimulation (TMS) is a relatively new treatment that has been shown to help people with drug-resistant depression.

In addition to the original TMS, there are also repetitive TMS (rTMS), and deep transcranial magnetic stimulation (deep TMS). Deep TMS therapy was developed after rTMS therapy, and they are relatively similar. During rTMS therapy, an eletromagnetic field is pulsed into the brain at increasing strength. During deep TMS an electomagnetic field is induced using different coil type than rTMS at a continuous strength. One of the differences between rTMS therapy and deep TMS therapy is that rTMS repeatedly pulses the electromagnetic field to become stronger, while deep TMS does not.

More details about the processes and differences between deep TMS and rTMS are presented below. Active Recovery TMS specializes in deep TMS using technology provided by Brainsway.

What is TMS?

During transcranial magnetic stimulation (TMS) an electromagnetic field is created, by an electromagnetic coil and placed near the head. An electric current runs through the coil generating a magnetic field, as pictured below. The field painlessly stimulates brain cells, that are commonly responsible for depression. This process changes how targeted neural networks fire and changes the way the brain in depressed patients thinks over time. Clinical results show that mood changes positively.

The short version:

- A TMS coil is placed on the head.
- An electric current is run through the coil, generating an electromagnetic field.
- Areas of the brain associated with mood are stimulated.
- Over time, mood centers in the brain are coaxed into changing and alleviating depression.

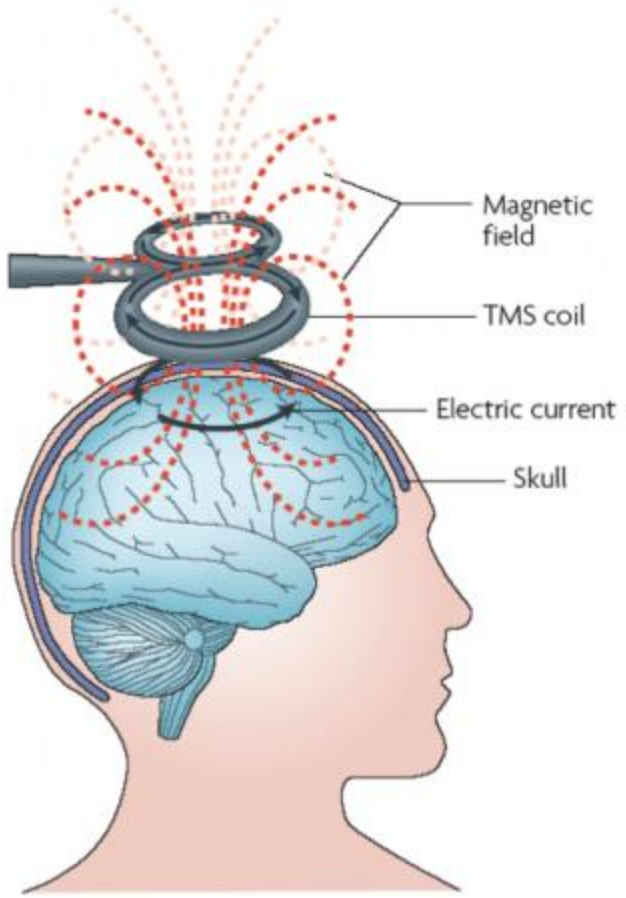

Image from: The Brain Stimulator

During the first visit, patients need to remove anything that is magnetically sensitive from their bodies. Patients need to tell their doctors about any implants they have in their bodies, as some implants are not conducive to TMS treatment. The TMS machine makes some noise, so patients and are given earplugs for comfort. The first session will be the calibration session, where many settings will be tested. Each patient will have a specific setting to best fit to the shape and size of their head. These will be the settings used throughout the rest of treatment. The patient and their doctor will determine the number of total treatments required.

Again, the procedure is entirely painless. TMS therapy sessions last between 20-40 minutes and are an outpatient procedure. That means no hospital stays or anesthesia, and patients will be fine to drive home or to work and resume regular activities once treatment is completed. Both deep TMS therapy and rTMS therapy are similar, in that an electromagnetic field is used for treatment. The deep TMS electromagnetic field penetrates deeper than the rTMS electromagnetic field.

There are no systemic side effects of the treatment. Side effects include:

- Headache
- Neck Pain
- Scalp Discomfort

Overall any TMS treatment is:

- Quick
- Painless
- Easy to do

TMS therapy is recommended for depression patients that have had a hard time finding treatments that work for them. TMS was created as a less invasive treatment than ECT, where the patient has to go under anesthesia and electrodes are placed inside the head. Currently, TMS has been FDA approved to treat depression symptoms, and there are a number of clinical trials looking at many other uses for treatment as well.

The Difference Between Deep TMS and Repetitive TMS

Deep TMS and rTMS have both been shown to be safe methods of treating depression in patients. The significant differences between the two are stimulation depth, coil type, and the length of the session. Other than that, every part of the procedure remains the same as above.

Stimulation Depth

Deep TMS

Deep transcranial stimulation is designed to stimulate the reward and motivation pathways of the brain. The reward and motivation pathways are located in what is called the subgenual cingulate cortex. The subgenual cingulate cortex has been shown to be involved in depression since the 1940s. This area is approximately four centimeters in the forehead area. The depth varies by patient, and that is the reason for calibrating the strength of the electromagnetic field for treatment. Deep TMS is designed to stimulate these areas of the brain.

rTMS

rTMS therapy penetrates about one and a half centimeters into the brain. The focal area of the electromagnetic field is on the dorsolateral prefrontal cortex, which is located near the forehead. This area lies closer to the scalp than the area talked about above.

The dorsolateral prefrontal cortex is responsible for executive and cognitive functions. These functions include abstract reasoning, working memory, intention formation, goal-directed action, attention control, and negative control. Researchers believe that a defect in negative control can lead to depression. Depression is thought to develop when the ability to let something go that is unattainable, or to disengage a goal-oriented thought process is

defective. An example of this behavior would be the temporary sadness that sets in for children when they are told no.

Coil Type

Deep TMS

Deep TMS therapy uses an H1-coil. When the patient goes in for treatment, the device looks like a hat. The coils are inside the hat, and they take up the entire front half of the hat. Regular TMS uses a figure-8 coil, as shown above.

The H1-coil applies the magnetic field radially, and this means that the field is applied all around the front of the head. Whereas the figure-8 coil applied the magnetic field vertically, or at one point on the head. The benefit of having the field applied all around the front of the head, is that the field can penetrate deeper into the brain without harming the patient.

rTMS

rTMS therapy uses the figure-8 coil, as shown in the picture above. The difference between rTMS and TMS is that the coil delivers multiple pulses of electromagnetism, where TMS is a continuous delivery. The repetitive pulses allow for the magnetic field to become increasingly strong without harming the patient.

Length of Session

Deep TMS

Deep TMS sessions last about 20 minutes.

rTMS

rTMS sessions last about 40 minutes. It takes longer to increase the strength of the magnetic field using repetitive pulses.

Overview of the Differences

- Deep TMS therapy penetrates the brain by about 4 cm to hit additional nerve centers that cause depression.
- rTMS therapy penetrates the brain by about 1 cm.
- Deep TMS therapy uses many coils that surround the front of the head. The apparatus used in the office looks like a hat.
- rTMS therapy uses the figure-8 coil and is placed near the head.
- Deep TMS treatments last 20 minutes.
- rTMS treatments last 40 minutes.

Other than the physical look of the devices used to treat patients, and the time that it takes to administer treatment, the real difference is the depth of penetration by the electromagnetic field. In a review by Minichino et al. it was found that deep TMS therapy had longer lasting cognitive effects on patients with drug-resistant depression over rTMS therapy.

The group looked at the efficacy of ECT (electroconvulsive therapy), rTMS, and deep TMS. Overall, they found ECT to be the most effective treatment, next deep TMS, and lastly rTMS. As mentioned above there are considerable drawbacks to ECT therapy, and a patient has to go under anesthesia to have electrodes placed in the head. Patients cannot drive home after the procedure, they may have to take the day off, and there are usually three treatments a week. Both deep TMS and rTMS are noninvasive outpatient treatments. The patient is even able to return to work the same day. Treatments are usually five days a week for three weeks.

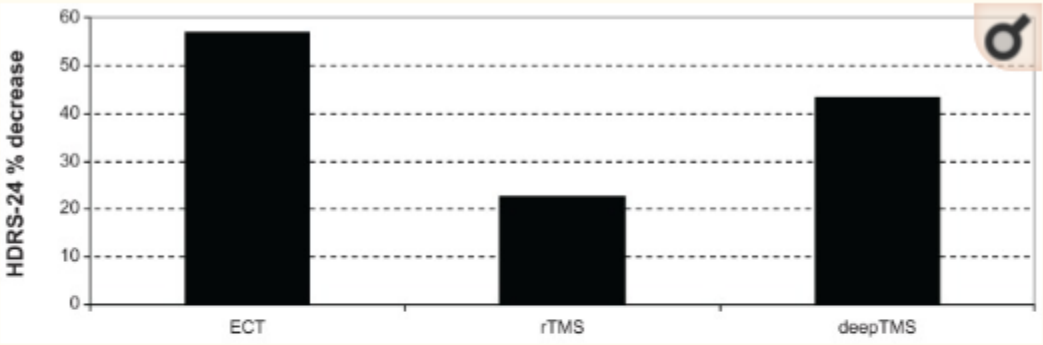

Figure 2

HDRS-24 % decrease in patients treated with ECT, rTMS, and deepTMS from baseline to the fourth week of treatment.

Abbreviations: HDRS, Hamilton Depression Rating Scale; ECT, electroconvulsion therapy; rTMS, transcranial magnetic stimulation; deepTMS, deep transcranial magnetic stimulation.

Image from Minichino et al.

The data above shows that ECT gave the best results (left), then deep TMS (right), then rTMS (middle). The group did mention the fact that they only used one evaluation type for patients and decided that was a limitation of the study.

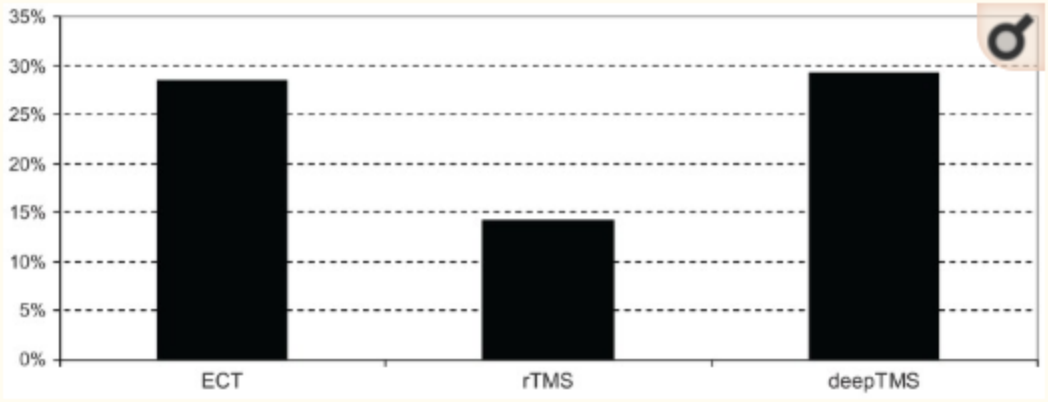

Figure 6

Percentage of remitted patients.

Abbreviations: ECT, electroconvulsion therapy; rTMS, transcranial magnetic stimulation; deepTMS, deep transcranial magnetic stimulation.

Image from Minichino et al.

This chart shows remission rate, and deep TMS (right) patients appear to remain depression-free longer than both ECT (left) and rTMS (middle) patients.

The goal of any health care provider is to administer the best treatments with the smallest amount of pain and suffering for the patient. That is why Active Recovery offers deep TMS over any other non-prescription drug treatment for depression.