



**National University of Medical Science, Spain**  
**(NUMSS)**

**Repetitive Transcranial Magnetic Stimulation  
Therapy for Motor Recovery in Parkinson's  
Disease**

by

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## Introduction

Parkinson's disease (PD) affects 1-2 per 1000 of the population at any time. PD prevalence is increasing with age and PD affects 1% of the population above 60 years. PD is regarded as a movement disorder with three cardinal signs: tremor, rigidity and bradykinesia.

The cause of PD is unknown in most cases. Genetic risk factors have been identified, including monogenetic causes that are rare in unselected populations. Some genetic factor can be identified in 5-10% of the patients. Several environmental factors are associated with increased risk of PD. Autopsy studies show that the clinical diagnosis of PD is not confirmed at autopsy in a significant proportion of patients. Revised diagnostic criteria are expected to improve the clinician's accuracy in diagnosing PD. Increasing knowledge on genetic and environmental risk factors of PD will probably elucidate the cause of this disease within the near future(1).

In rTMS an electromagnetic coil is placed against the scalp. This stimulates areas of the brain related to mood. In this therapy the electric activities in the brain are influenced by the magnetic fields. In this procedure of treatment, multiple parameters are involved that can be changed to reach different treatment goals, these concurrent parameters include the number of stimulations, stimulation intensity, stimulation frequency, length of intervals between stimulations & the stimulated areas of the brain(2).

Transcranial magnetic stimulation (rTMS) may influence the progression of PD compared with levodopa(3).

## Abstract

Previous studies in patients with Parkinson's disease have reported that a single session of repetitive transcranial magnetic stimulation (rTMS) can improve some or all of the motor symptoms for 30 to 60 minutes. A recent study suggested that repeated sessions of rTMS lead to effects that can last for at least 1 month(4).

Patients were randomly assigned to a group received a total of 2000 pulses delivered at the primary motor cortex in both brain hemispheres everyday for 10 days, either a frequency of 10-20 Hz or 1 Hz(5).

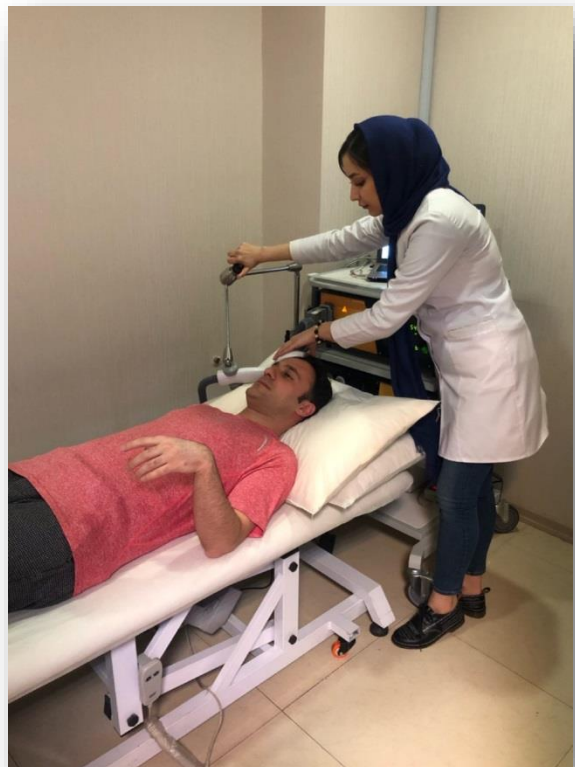
Low & high frequency rTMS of the primary motor cortex lead to significant but differential changes in patients with PD both on clinical & electrophysiological grounds(6).

## Method & Device

Device: Repetitive transcranial magnetic stimulation (rTMS)

DLPFC Active rTMS: Each treatment will consist of 2000 stimuli (50 X 4-second trains of 40 stimuli at 10 Hz, administered every 30 seconds for 25 minutes). Stimulus intensity for the first and second trains will be 80 and 90 percent of motor evoked potential (MEP), respectively. If no adverse effects are observed following each of the first two trains, then the subsequent trains will be given at MEP threshold.

M1 Active rTMS: Stimulation will be applied one side at a time, to the motor cortex site at 90 percent of each subject's motor threshold intensity, and at a frequency of 10 Hz with 1000 stimuli per side (25 X 8-second trains of 40 stimuli)(7).



## Results

We confirmed that HF-rTMS over the M1 foot area significantly improved motor symptoms in patients with PD. In addition, daily repeated stimulation was not significantly more effective than a single session of stimulation, but may be effective for maintaining the improvement in motor symptoms in patients with PD(8).

Multi session of high frequency rTMS especially bilateral with a total of 18000-20000 pulses appears to be the optimal parameters for motor improvement of PD(4).

Unified Parkinson's Disease Rating Scale (UPDRS), walking time, key-tapping speed, and self-assessment scale were measured for each patient before and after each rTMS session and before and after the monthly sessions. Compared to occipital stimulation, 20 Hz rTMS over motor areas improved all measures in both early and late groups. The effect built up gradually during the sessions and was maintained for 1 month after, with a slight reduction in efficacy. Interestingly, the effect was restored and maintained for the next month by the booster sessions. We conclude that 20 Hz rTMS can lead to cumulative and long-lasting effects on motor performance(4).

The benefits seen were almost always observed with regard to bradykinesia or dyskinesia scores. Changes in gait have also been shown to result from rTMS treatment such that gait speed improved after a single session of high frequency rTMS as assessed using the Timed Up and Go test(9).

## Conclusions

The rTMS showed significant therapeutic effects on motor in PD. HF-rTMS showed a significant positive antidepressive effect in PD only over DLPFC(10).

Medical therapy substantially improves quality of life and functional capacity in PD; however, most patients develop complications after 5 years of treatment, including dyskinesia and motor fluctuations. Surgical techniques, including deep brain stimulation, improve advanced symptoms above the best medical therapy, although less than 5% of the PD population may be eligible for the procedure. During the past 2 decades, repetitive transcranial magnetic stimulation (rTMS) has been closely examined as a possible treatment for PD.5–7 As a noninvasive procedure, rTMS does not require surgery or anesthesia. It delivers repeated magnetic pulses to a specific brain area within a short time through a stimulation coil placed over the scalp. The repeated magnetic pulses not only alter excitability at the site of stimulation but also influence brain regions anatomically connected to the stimulation site. Because rTMS can produce changes in neural activity and behavior that last well after stimulation, this technique has generated much interest as a potential therapeutic intervention for patients with PD(11).

Recent studies have shown that rTMS has a positive effect on motor functioning in patients with PD. Most studies have assessed motor outcomes in Parkinson's such as the UPDRS III in addition to various motor tasks such as gait or hand function with the use of rTMS treatments(4, 8, 12). The cumulative results of such investigations reveal that high frequency rTMS delivered over motor areas of the cortex (both primary and supplementary motor areas) tend to improve motor scores on the UPDRS III following frequent sessions (ranging from daily to one session per week) of treatment(13-15) and with some observations showing maintenance of improvements for up to a month after treatment(12, 14).

Further, gait speed improvements were reported in conjunction with reductions in bradykinesia following rTMS treatments twice a week over the course of a month that persisted for at least a month following intervention.(14) Notably, one study examined frequent high frequency rTMS delivered to the primary motor cortex and tracking changes in functional MRI activity.

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