Phys Med Rehab & Electrodiagnosis 2019; 1(3): 145-9
DOI: https://doi.org/10.22122/pmre.v1i3.33 **Published by** *Vesnu Publications*

Original Article

Evaluation of Repetitive Transcranial Magnetic Stimulation on the Pain of Patients with Fibromyalgia

Received: 09 Apr. 2019
Accepted: 19 Aug. 2019
Published: 05 Sep. 2019

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Keywords
Fibromyalgia; Pain; Treatment

Abstract

Background: Repetitive transcranial magnetic stimulation (rTMS) is amongst the famous reviewed types of noninvasive therapy, newly used to remedy fibromyalgia (FM), a persistent pain disturbance. The aim of this study is to examine the effects of rTMS on the pain of FM in patients.

Methods: A total of 24 patients with FM were recruited and equally divided to randomly receive 4000 pulses at 10 Hz rTMS treatment or sham condition for ten twenty-minute sessions (5 sessions a week over two weeks). Brief Pain Inventory (BPI), FM Impact Questionnaire (FIQ), and McGill Pain Questionnaire (MPQ) were completed before the intervention and after the first, the second, and the fourth weeks of the intervention.

Results: There were no significant differences between groups in terms of sociodemographic variables and clinical characteristics along with analgesic treatments. Analysis indicated that average intensity in patients' pain was remarkably lower in active group than in the sham one at the second and fourth weeks. Also, McGill affective subscore was considerably lower in active rTMS group than the sham group at the fourth week. Quality of patients' life at the first, second, and fourth sessions was significantly higher in the active group than in the sham group.

Conclusion: The results of this research showed that excitatory rTMS at prefrontal cortex (PFC) of patients had an effective and long-lasting impact on pain reduction and improvement of patients' quality of life (QOL).

How to cite this article: Rezasoltani Z, Azizi S, Najafi S, Dadarkhah A, Hamidipanah S, Abedi M. **Evaluation of Repetitive Transcranial Magnetic Stimulation on the Pain of Patients with Fibromyalgia.** Phys Med Rehab & Electrodiagnosis 2019; 1(3): 145-9.

Introduction

Fibromyalgia (FM) -a persistent pain disorder- is characterized by wide-spreading pain and tenderness in muscle, often along with sleep disorders, depression, and tiredness.[1] This affects 1-3 percent of the whole people and is far more prevalent in women than in men.[2-4] It is the second most

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common condition seen by rheumatologists.[5-7] However, the cause and pathogenesis of FM have been weakly noticed;[5] it seems that the pathophysiology can result in sensibility of central pain processing,[8,9] dysfunctional pain inhibition,[10] and abnormalcies in cortical agitation.[11] Thus, there can be a reduction in rostral anterior cingulate activity in reply to pain stimulation, showing an abnormality in the descending pain serialization amperage.[10]

A multidisciplinary treatment strategy has been recommended for FM syndrome (FMS), including pharmaceuticals, behavioral interventions, physical therapy, and exercise.[12,13] Recent developments in neuroimaging studies, focusing on centrally-augmented pain processing for individuals with FMS suggest that therapeutic regimens targeting the central nervous system (CNS) may be effective as well.[14,15] Among the well-known investigated types of noninvasive brain stimulation (NIBS) is repetitive transcranial magnetic stimulation (rTMS) including a secure method for exiting the cerebral cortex,[16] inducing changes not only bilaterally but also in a number of far subcortical and cortical regions.[17,18] Over the last few decades, there has been a rapid rise in the use of rTMS. However, previous studies have failed to address the precise effects of rTMS on chronic pain in particular in FM. This study aims to test the effect of rTMS on the pain of patients with FM.

Methods

A total of 30 patients with FM were recruited for this study. Of the initial sample, 24 subjects completed sessions and returned the questionnaires. The participants were divided into two groups on the basis of intervention: active treatment (n = 12) and sham (n = 12).

In all cases, patients' consent was obtained and this study was approved by the Ethics Committee of AJA University of Medical Sciences, Tehran, Iran. All samples were thoroughly checked for having pacemaker, history of head trauma, epilepsy, stroke, bipolar disorder, schizophrenia, inflammatory or autoimmune disease, rheumatic disease, hypertension (HTN), and being pregnant. All participants met the last clinical FM diagnostic criteria (2011). They did not change medication for 6 months of starting the trial. Participants were matched in terms of sociodemographic variables, clinical characteristics, and concomitant analgesic treatments.

Applied to the left prefrontal region using a figure-of-eight shaped coil, rTMS was utilized in twenty-minute sessions each morning for 10 sessions (5 sessions per week over two weeks). The stimulation protocol was consisted of 5-second stimulations (10 Hz pulses) with power level of 120% of resting motor threshold (rMT), followed by 10-second intervals. This protocol was used for whole subjects but the coil was reversed in the sham patients. The coil was placed in a parasagittal direction, 6 cm over the region that created right abductor pollicis brevis muscle action for rMT testing.

Brief Pain Inventory (BPI) (to assess pain intensity and interference), FM Impact Questionnaire (FIQ) [to evaluate the quality of life (QOL)], and McGill Pain Questionnaire (MPQ) (to evaluate the sensate amount of pain) were completed before the intervention and instantly after the first, the second, and the fourth weeks of the intervention.

Results

Demographic variables and clinical characteristics did not differ significantly between groups before starting the study (Table 1).

Table 1. Demographic and clinical characteristics of patients included in the study

	rTMS	Sham	P
Age (year)	45.8 ± 7.9	47.9 ± 8.7	NS
Education (year)	11.0 ± 2.7	10.6 ± 1.7	NS
Pain duration (year)	4.5 ± 1.8	4.3 ± 1.7	NS
Average pain intensity (0-10)	7.1 ± 1.1	6.6 ± 1.0	NS

Values are expressed as mean ± standard deviation (SD)
rTMS: Repetitive transcranial magnetic stimulation; NS: Non-significant

Table 2. Neuropsychologic tests in the sham and repetitive transcranial magnetic stimulation (rTMS) groups before study, after the first, the second, and the fourth weeks

		Baseline		Week 1		Week 2		Week 4	
		Sham	rTMS	Sham	rTMS	Sham	rTMS	Sham	rTMS
MPQ	VAS	7.70 ± 0.60	6.30 ± 0.60	7.00 ± 0.50	5.30 ± 0.50	6.50 ± 0.70	4.60 ± 0.80	6.80 ± 0.60	3.60 ± 0.60
	Sensory	12.80 ± 1.70	10.20 ± 1.90	10.70 ± 1.50	9.20 ± 1.60	7.50 ± 1.50	7.50 ± 1.60	9.20 ± 1.00	6.60 ± 1.10
	Affective	5.70 ± 0.60	3.70 ± 0.70	5.00 ± 0.80	3.30 ± 0.80	3.70 ± 0.70	2.90 ± 0.70	3.80 ± 0.60	1.90 ± 0.70
FIQ	Total score	35.40 ± 3.60	41.40 ± 3.90	38.60 ± 3.20	50.70 ± 3.50	36.60 ± 3.10	52.50 ± 3.40	35.20 ± 3.10	56.80 ± 3.60
BPI	Pain intensity	0.60 ± 0.05	0.62 ± 0.05	0.67 ± 0.06	0.50 ± 0.06	0.70 ± 0.04	0.50 ± 0.04	0.70 ± 0.04	0.50 ± 0.04
	Interference	0.60 ± 0.07	0.60 ± 0.07	0.58 ± 0.09	0.60 ± 0.10	0.70 ± 0.07	0.60 ± 0.07	0.70 ± 0.06	0.60 ± 0.06

Values are expressed as mean ± standard deviation (SD)
MPQ: McGill Pain Questionnaire; FIQ: Fibromyalgia Impact Questionnaire; BPI: Brief Pain Inventory; rTMS: Repetitive transcranial magnetic stimulation; VAS: Visual Analogue Scale

Analysis of the patients' pain intensity by BPI showed that the mean of pain severity was equal in the two groups at the baseline and the first week after the intervention; however, it was considerably lower in active group than in the sham group at the second and the fourth weeks of the therapy. Also, at the end of fourth week, McGill affective subscore was remarkably lower in active group compared with the sham group. Besides, QOL at the 1st, 2nd, and 4th weeks was significantly higher in the active group than in the sham stimulation group (Table 2).

Discussion

FMS is a persistent pain condition that is considered hard to treat and is along with severe comorbidity.[1,19,20] The results of this randomized, sham-controlled study showed that excitatory rTMS at the prefrontal cortex (PFC) had an effective and long-lasting impact on significant pain reduction. McGill information offered that the treatment group experienced a great decrease in Visual Analogue Scale (VAS) subscore in the first and the fourth weeks and affective subscore in the fourth week of treatment. But there was no actuarial discrepancy in sensory subscore during the time of rTMS versus sham treatment.

The data are consistent with those of Short et al. who found that rTMS might decrease FM pain via adjusting of pain processing.[21]

TMS is a brain interposition that regulates activity in separate cortical regions and associated neural circuits through the noninvasive excitation of intracerebral currents over many sessions of stimulation. Many studies defend the notion that regular high-frequency stimulation enhances cortical incitement.[22,23] Thus, TMS over motor cortex at high frequencies enhances motor-evoked potentials. Repetitive stimulation of the PFC starts up a cascade of events in the PFC and in linkage with limbic areas.[24] Prefrontal TMS sends information to important mood-regulating zones containing the orbitofrontal cortex (OFC), cingulate gyrus, and hippocampus, and can induce dopamine release in the caudate nucleus.[24-26] FM is associated with deficits in intracortical frequencies. So, rTMS may reduce FM pain by increasing intracortical frequency.

The analgesic effects of rTMS in patients with FM were considerable after 7 days of stimulation. These effects are consistent with the observation that pain relief peaks first week after rTMS.[27-29]

FIQ data suggest that the treatment group experienced a great decrement in pain and better function along with baseline at the end of 1ST, 2nd, and 4th weeks of treatment. This result is steadfast with those of Mhalla et al.[11] and Passard et al.[30] who found that rTMS of the PFC bettered QOL in people with FM. rTMS-induced improvement in QOL might be the result of modulation of neuronal circuits not directly related to pain processing.

Conclusion

The results of this research showed that excitatory rTMS at PFC of patients had an

effective and long-lasting impact on pain reduction and improvement of patients' QOL.

Acknowledgments

The authors are indebted to all participating patients in this study for their cooperation.

Conflict of Interest

Authors have no conflict of interest.

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