

CASE REPORT

Low-frequency rTMS in fibromyalgia: a case report

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Background: Fibromyalgia is a chronic pain syndrome featuring widespread pain, sleep disturbance, fatigue, and psychological distress. Repetitive transcranial magnetic stimulation (rTMS) is an emerging non-invasive option for neuromodulation of symptoms.

Case summary: A 56-year-old female private employee with a 7-year history of persistent pain, fatigue, sleep disturbance, anxiety, depression, and functional limitation despite 6 years of treatment with pregabalin and duloxetine was diagnosed using the 2016 revised American College of Rheumatology criteria with fibromyalgia. She received 20 sessions of low-frequency right dorsolateral prefrontal cortex (DLPFC) rTMS over 4 weeks using 1 Hz stimulation, 1200 pulses/session, 8 trains, and 90% resting motor threshold. Post-treatment assessment showed improvement in numerical pain rating scale (NPRS) from 7 to 3, McGill pain questionnaire (MPQ) total pain score from 24 to 8, Hamilton anxiety rating scale (HAM-A) from 15 to 9, Hamilton depression rating scale (HAM-D) from 16 to 8, and 36-item short form health survey (SF-36) physical functioning from 20 to 75. No adverse events were reported.

Conclusion: Low-frequency right DLPFC rTMS may be a safe adjunctive care option for selected patients of fibromyalgia with associated mood symptoms. However, without long-term follow-up or sham control, causality cannot be proven from a single case.

Keywords: fibromyalgia, rTMS, depression, pain, quality of life

Key message: Low-frequency rTMS targeting the right DLPFC may serve as an effective and well-tolerated adjunctive therapy in fibromyalgia. Resulting in symptomatic improvements in pain, mood, and quality of life beyond what conventional pharmacological management provided.

Introduction

Fibromyalgia is a chronic pain syndrome characterized by widespread pain, fatigue, cognitive impairment, and psychological distress. Predominantly affecting women with a prevalence of 0.2–6.6% in the general population (1). The pathophysiology is complex, contributing to central sensitization, dysfunctional pain modulation pathways, and cortical excitability changes. Resulting in impaired pain regulation and emotional distress. Multidisciplinary management strategies include pharmacological treatments (e.g., pregabalin, duloxetine), behavioral therapies, physical rehabilitation, and emerging alternative therapies such as repetitive transcranial magnetic stimulation (rTMS) (2).

rTMS is a non-invasive technique that mediates neuromodulation of the DLPFC to regulate pain pathways and improve psychological symptoms with minimal side effects (3). Low-frequency (1 Hz) rTMS of the right dorsolateral prefrontal cortex (DLPFC) has been attributed to enhancing pain inhibition and improving quality of life in fibromyalgia. However, there is a lack of standardized protocols, and larger trials are needed (4).

Case description

This case report assesses the effectiveness of low-frequency rTMS targeting the DLPFC in alleviating fibromyalgia symptoms. A 56-year-old female, working as a private employee, presented with a 7-year history of widespread musculoskeletal pain associated with fatigue, sleep disturbance, reduced activity tolerance, and multiple tender areas. She was diagnosed with fibromyalgia according to the 2016 revised American College of Rheumatology criteria. The diagnostic workup did not suggest alternative inflammatory, endocrine, neurological, or rheumatological pathology associated with chronic widespread pain. She had been receiving medical treatment for fibromyalgia for the past 6 years, including pregabalin and duloxetine, along with conservative measures such as activity modification, sleep hygiene advice, and pain management strategies. However, she continued to have persistent symptoms.

She also reported symptoms of anxiety and depression for the past 3 years. At baseline, she had significant functional limitations, including difficulty in prolonged standing, walking, performing household activities, maintaining work efficiency, and participating in routine social and recreational activities. She reported sleep disturbance in the form of non-restorative sleep and frequent awakenings, contributing to daytime fatigue. Due to chronic pain, fatigue, low mood, and anxiety symptoms, her occupational performance and social participation were considerably reduced.

After baseline clinical assessment and documentation of outcome measures, she underwent treatment with low-frequency rTMS targeting the DLPFC (Figure 1) (2).

The intervention chronology included motor hotspot identification, resting motor threshold determination, localization of the right DLPFC, and scheduled rTMS sessions over 4 weeks. The rTMS sessions were delivered using a Magstim Rapid² stimulator with a D70 active feedback compensation (AFC) figure-of-eight coil. Treatment consisted of 20 sessions of low-frequency rTMS delivered at 1 Hz and 90% resting motor threshold (RMT). Each session lasted approximately 27 minutes and included eight trains of 150 seconds each, separated by 60-second inter-train intervals, delivering a total of 1200 pulses per session. Sessions were administered 5 days per week, with an inter-session interval of approximately 24 hours (3). Pharmacological support with pregabalin and duloxetine was continued during the treatment period without major medication changes (4). The treatment was well tolerated throughout the course of rTMS.

For selection of the optimal stimulation site and intensity, the RMT was determined by single-pulse stimulation over the right primary motor cortex (M1). The coil was systematically moved to identify the “motor hotspot,” the scalp location where stimulation consistently produced visible right thumb twitches (abductor pollicis brevis muscle) at rest. The RMT was defined as the lowest stimulator output intensity that produced a visible thumb twitch in the abductor pollicis brevis in at least five out of ten consecutive trials; motor response was assessed visually, and electromyography (EMG) recording was not used, consistent with the conventional 5-cm localization method. Once the RMT was established, the stimulation coil was repositioned 5 cm anterior to the motor hotspot to target the right DLPFC, aligning it in a parasagittal line at a 45° angle to the midline with the handle pointing posteriorly (2). No adverse events were reported during or after the rTMS sessions. The patient did not experience headache, scalp discomfort, dizziness, excessive fatigue, or any seizure-like event. Seizure risk screening was performed before initiating rTMS, and no contraindication to stimulation was identified.

Timeline

Symptom onset preceded presentation by 7 years, with pharmacological treatment (pregabalin, duloxetine) ongoing for the prior 6 years without adequate relief. Baseline outcome assessment was followed by 20 sessions of low-frequency right DLPFC rTMS delivered over 4 weeks (5 sessions/week), and post-treatment outcome assessment was performed on completion of the rTMS course; extended follow-up was not undertaken.

Outcomes assessed were reduction in pain intensity with the help of the numerical pain rating scale (NPRS). We assessed pain related depression, anxiety, impact of pain, and quality of life using the McGill pain questionnaire (MPQ), the Hamilton anxiety rating scale (HAM-A),

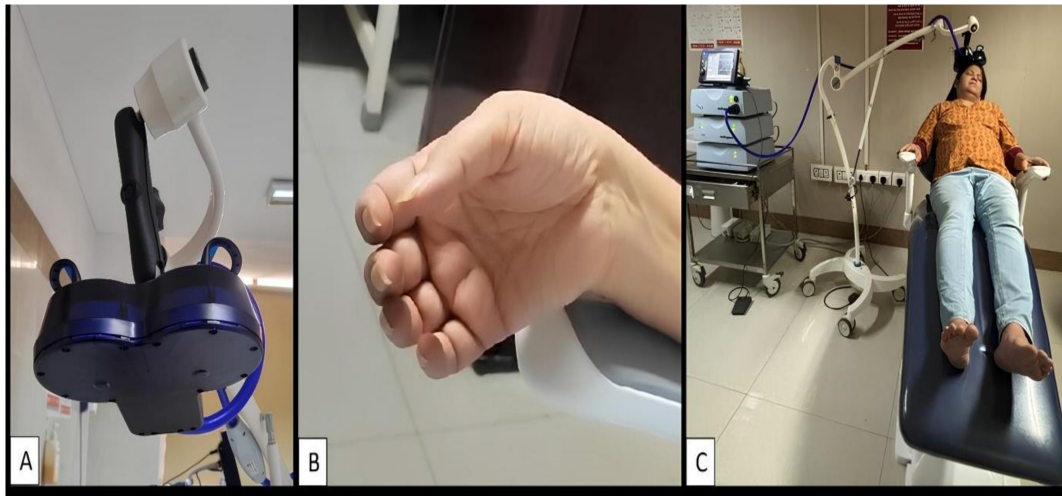


FIGURE 1 | Application of low-frequency rTMS for fibromyalgia. **(A)** Figure-of-eight coil used for rTMS delivery. **(B)** Localization of the motor hotspot by observing visible right thumb twitch in the abductor pollicis brevis during resting motor threshold determination. **(C)** Low-frequency (1 Hz) rTMS applied over the right dorsolateral prefrontal cortex (DLPFC), positioned 5 cm anterior to the motor hotspot.

the Hamilton depression rating scale (HAM-D), and the 36-item short form health survey (SF-36). Post-rTMS treatment evaluations showed marked reductions in pain levels (Table 1).

Patient perspective

The patient reported subjective improvement in pain, sleep quality, daily activity tolerance, work efficiency, and confidence in performing routine activities after completion of the rTMS sessions and expressed satisfaction with the tolerability of the treatment.

Discussion

The precise mechanism by which rTMS regulates pain is not fully understood. However, rTMS exerts its effects by modulating electrical activity in specific brain structures through the application of magnetic pulses. Low-frequency rTMS targeting the right DLPFC is proposed to enhance pain inhibition by modulating limbic structures involved in pain and emotion. Increased DLPFC activity may reduce hyperactivity in key pain-processing regions, thereby improving pain regulation and quality of life and alleviating anxiety and depression (2).

Neuroimaging studies have also shown to support its potential role in restoring disrupted connectivity (5). There is evidence indicating that rTMS may decrease nociceptive hyperexcitability and enhance pain modulation via thalamic and cingulate connectivity (2). Sustained symptom relief with rTMS may require individualized and extended maintenance protocols (1, 4). Therefore, long-term studies are needed to optimize rTMS parameters and explore its biochemical effects in fibromyalgia (1, 2).

In the presented case, improvement was observed in pain, psychological symptoms, and quality-of-life measures following 4 weeks of low-frequency rTMS. However, these findings should be interpreted cautiously. The observed clinical improvement cannot be attributed solely to rTMS as the patient continued pregabalin and duloxetine during the intervention period. Therefore, a possible synergistic effect between ongoing pharmacological treatment and rTMS may have been in play. Additionally, factors such as placebo effects, patient expectation, and the natural fluctuation of fibromyalgia symptoms may also have influenced the observed improvement. Therefore, although this case suggests that rTMS may be a useful adjunctive treatment option, it does not establish independent efficacy or causality.

When comparing with previous studies, the improvement observed in our case is consistent with reports suggesting positive outcomes of rTMS in fibromyalgia. Our patient showed a reduction in NPRS from 7 to 3, MPQ total pain score from 24 to 8, HAM-A from 15 to 9, HAM-D from 16 to 8, and improvement in SF-36 physical functioning from 20 to 75. Silva et al. reported greater pain reduction with add-on M1-rTMS than sham stimulation at week 8, although the analgesic effect reduced by week 16 while functional improvement persisted (6). Kankane et al. reported significant improvement in pain, anxiety, depression, and fibromyalgia impact scores with both low- and high-frequency DLPFC stimulation, with no significant difference between protocols (7). Similarly, Nation et al. reported improvement in pain, fibromyalgia impact, depression, and anxiety after 20 sessions of low-frequency right DLPFC rTMS, which closely resembles our protocol and clinical response (8).

Nonetheless, the evidence remains heterogeneous necessitating the need of cautious interpretation.

TABLE 1 | Pre and post-treatment outcome scores comparison.

Outcome measure	Pre-treatment-score	Post-treatment-score	Percentage changes
NPRS	7	3	57.1%
McGill pain questionnaire (MPQ)			
Sensory component	11	4	63.6%
Affective component	5	1	80.0%
Evaluative component	4	1	75.0%
Miscellaneous component	4	2	50.0%
Total pain score	24	8	66.7%
Pain Intensity	12	6	50.0%
Hamilton rating scale			
Hamilton anxiety rating scale	15	9	40.0%
Hamilton depression rating scale	16	8	50.0%
SF-36 quality of life domains			
Physical functioning	20	75	275.0%
Role limitations due to physical health	25	80	220.0%
Role limitations due to emotional problems	20	70	250.0%
Fatigue	20	0	100.0%
Emotional well-being	30	65	116.7%
Social functioning	25	75	200.0%
Pain	68	20	70.6%
General health perceptions	35	70	100.0%

SF-36, 36-item short form survey scoring; NPRS, numerical pain rating scale.

Note: For the SF-36 Pain domain, scores were derived such that a lower value indicates milder pain-related interference; hence, unlike other SF-36 domains, a decrease from pre- to post-treatment reflects improvement.

Cuenca-Martínez et al. suggested stronger evidence for high-frequency M1 stimulation in reducing pain, while evidence for low-frequency protocols and effects on anxiety and depression is less robust (9). Velickovic and Radunovic also emphasized that M1 stimulation has the strongest support for analgesic benefit, whereas DLPFC stimulation may be more relevant when affective, cognitive, and mood-related components are prominent (10). The possible mechanisms include enhancement of descending pain inhibition, modulation of prefrontal-limbic circuits, reduction of central sensitization, and changes in thalamic, cingulate, and insular connectivity. However, Ackermann et al. showed that improvement after DLPFC stimulation may partly overlap with placebo and nonspecific neuromodulatory effects (11). Therefore, although our case supports low-frequency right DLPFC rTMS as a possible adjunctive option in fibromyalgia with anxiety and depressive symptoms, it should not be considered proof of independent efficacy.

Unlike pharmacological treatments, rTMS is a non-invasive neuromodulation technique with a favorable

safety profile and may have a role as an adjunctive therapy in selected patients with fibromyalgia. However, larger controlled studies with standardized protocols, control groups, and long-term follow-up are required to determine its independent therapeutic effect and sustained clinical benefit (12). This case report has several limitations. First, it describes the outcome of a single patient; therefore, the findings cannot be generalized to all patients with fibromyalgia. Second, follow-up assessments at 1 month, 3 months, and 6 months were not available; therefore, the long-term durability and sustainability of the observed improvement after rTMS could not be assessed. Third, as the patient continued pregabalin and duloxetine during the intervention period, the independent effect of rTMS cannot be established. Fourth, the absence of a sham-control condition means that placebo effects, patient expectation, and natural fluctuation of fibromyalgia symptoms may have contributed to the observed improvement. Fifth, the DLPFC was localized using the conventional 5-cm anterior offset from the motor hotspot rather than neuronavigation or the Beam F3 method, which are considered more accurate and may have resulted in less precise coil placement. Sixth, the lack of a disease-specific tool like the Fibromyalgia Impact Questionnaire (FIQ/FIQR) restricts a comprehensive evaluation of the symptomatic burden specific to fibromyalgia. Finally, objective neurophysiological or imaging studies were not performed to confirm the proposed mechanisms of neuromodulation. Further on, larger controlled studies with standardized protocols and long-term follow-up are required to confirm the efficacy and durability of low-frequency rTMS in fibromyalgia.

Clinical learning points

This case illustrates that low-frequency right DLPFC rTMS may yield concurrent improvement in pain, anxiety, depression, and quality of life in fibromyalgia refractory to prolonged pharmacotherapy, supporting its consideration as a well-tolerated adjunctive option pending confirmation in controlled trials.

Data availability statement

All data generated or analyzed during this study are included in the published article.

Ethics statement

The study was conducted in compliance with the Declaration of Helsinki and was approved by the Institutional Ethics Committee of the All India Institute of Medical Sciences,

Jodhpur (Approval Number: AIIMS/JDH/2025/03/PMR-326; Approval Date: 20-03-2025). All methods were carried out in accordance with relevant guidelines and regulations. This case report describes a patient who was prospectively evaluated and treated with predefined pre- and post-treatment outcome assessments as part of routine clinical care; written informed consent for participation was obtained from the patient.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images or clinical details.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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