ORIGINAL RESEARCH

77. Meta Analytic Review on The Effect of Repetitive Transcranial Magnetic Stimulation on Post-COVID 19 Memory Impairment and Related Cognitive Disorders

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Background: After the emergence of SARS-CoV-2 (covid-19) there have been reported cases of cognitive impairment in patients after recovering. The symptoms may persist for months and significantly impair quality of life. Repetitive transcranial magnetic stimulation (rTMS) is a non-invasive procedure that has shown promise in improving cognitive function in existing psychiatric and neurologic conditions. It is hypothesised that by stimulating targeted regions of the brain, rTMS may improve memory by enhancing synaptic plasticity, modulating cortical excitability, and promoting neurogenesis. Due to its non-invasive nature and its potential for improving quality of life, rTMS could be a neofrontier in treating memory impairment following covid-19 but remains underexplored.

Objective: To evaluate the effect of rTMS on memory outcomes in individuals with cognitive impairment after SARS-CoV-2 infection and related neurological conditions.

Methods: Two meta analytic studies were identified by searching reputable electronic databases using predefined keywords: "rTMS", "memory impairment", "COVID-19", "MCI". All searches were conducted on September 10, 2025. The included meta analyses had performed a comprehensive search from eight databases (PubMed, Embase, Cochrane library, Web of Science, CNKI, Wanfang, Sinomed, and VIP). Inclusion criteria: (1) randomised controlled trials (RCTs), (2) studies using rTMS intervention, regardless of wave type (Theta, beta, etc), (3) studies which had standardised memory outcomes reported, (4) cases with memory/cognitive impairment after infection with COVID-19 or patients with mild cognitive impairment (MCI). A qualitative inclusion was made for a case report of rTMS in a post covid patient.

The data extracted included sample size, stimulation parameters, memory outcome measures, standardized mean differences, and reported adverse effects. Data synthesis involved no new statistics and was purely descriptive based on the pooled effect sizes.

Risk of bias assessment relied on the original meta analyses. Both applied Cochrane risk of bias assessment tools and reported low to moderate risk across studies. Heterogeneity was assessed using I^2 statistics and was low to moderate for memory outcomes.

Results: Two meta analyses included a combined 23 randomised controlled trials on rTMS in mild cognitive impairment showed significant improvement in memory outcomes (Table 1). Zhang et al. reported a standardized mean difference (SMD) of 0.73 (95% CI: 0.48-0.97), while Hu et al. reported a SMD of 0.61 (95% CI: 0.41-0.82, I^2 = 22%). Subgroup analysis revealed stronger memory improvements with >10 sessions (SMD = 0.84) at 10 Hz stimulation (SMD = 0.86),

with multisite targeting. Follow up data revealed sustained benefits (SMD = 0.93). Adverse effects were minimal and transient. A case report in a post-COVID patient showed improvement in memory after 10 sessions of bilateral theta burst rTMS, supporting possible translatability to post-COVID cognitive impairment.

Conclusion: rTMS significantly improves memory in patients with MCI, particularly with optimized stimulation protocols. Although no randomised studies currently exist in post-COVID patients, one case report has demonstrated similar benefits. Similarities in cognitive profiles, along with a promising case report marks rTMS as a potential treatment option for post-COVID memory impairment. However, further research is needed to directly evaluate its efficacy in this population.

Table 1. Summary of Studies Evaluating rTMS for Memory Impairment

Study (Author, Year)	Sample Size	Population	rTMS Protocol	Memory Outcome	Effect Size (SMD, 95% CI)	Risk
Zhang et al. 2022	12 RCTs	MCI	10 Hz, >10 sessions	Improved (MoCA, RAVLT)	0.73 (0.48–0.97)	Low to moderate risk of bias
Hu et al. 2023	11 RCTs	MCI	10 Hz, multisite targeting	Improved (ADAS-Cog)	0.61 (0.41–0.82)	Low to moderate risk of bias
Case report, 2024	1 patient	Post-COVID memory loss	Bilateral theta burst	Improved (subjective and neuropsych)	N/A	N/A