



HIGH-FREQUENCY REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION AS AN ACCELERATOR OF FUNCTIONAL RECOVERY IN FACIAL NERVE NEUROPATHY

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Abstract

Objective: To evaluate whether 10 Hz repetitive transcranial magnetic stimulation (rTMS) added to conventional therapy provides superior functional recovery in peripheral facial nerve neuropathy. **Methods:** A comparative clinical analysis was performed in patients treated with conventional therapy plus 1 Hz rTMS, conventional therapy plus 10 Hz rTMS, or conventional therapy alone. **Outcomes** included House–Brackmann grade, Sunnybrook score and Yanagihara score. **Results:** The 10 Hz protocol produced the largest improvement: House–Brackmann improvement reached 86.5%, Sunnybrook score doubled, and Yanagihara recovery was approximately twofold greater than in the control group. **Conclusion:** High-frequency rTMS may be considered the leading neuromodulatory adjunct for early rehabilitation of facial nerve neuropathy.

Keywords: *facial nerve neuropathy; Bell's palsy; rTMS; 10 Hz stimulation; Sunnybrook; House–Brackmann*

Introduction

Peripheral facial nerve neuropathy remains one of the most visible and functionally disabling cranial neuropathies. Its annual incidence is commonly



reported at 15–30 cases per 100,000 population, and patients may experience impaired eye closure, oral incompetence, facial asymmetry and psychosocial discomfort [1,2]. Standard therapy improves many cases, but delayed recovery, synkinesis and residual asymmetry remain clinically important problems. Repetitive transcranial magnetic stimulation is increasingly discussed as a non-invasive method capable of modulating cortical excitability and promoting adaptive neuroplasticity. Previous randomized and meta-analytic data suggest that rTMS may improve symptoms in Bell's palsy, although optimal stimulation parameters remain debated [3,4]. The present manuscript focuses on the high-frequency component of the dissertation dataset, testing the assumption that 10 Hz stimulation provides stronger motor recovery than low-frequency stimulation or routine treatment.

Materials and Methods

The study included patients with clinically and neurophysiologically confirmed peripheral facial nerve neuropathy in the active recovery window after disease onset. The final comparative analysis comprised 103 patients: 35 received conventional therapy plus low-frequency 1 Hz rTMS, 37 received conventional therapy plus high-frequency 10 Hz rTMS, and 31 received conventional therapy alone. Clinical dynamics were assessed using the House–Brackmann grading system, Sunnybrook Facial Grading System and Yanagihara score. Treatment effects were evaluated before and after therapy, with follow-up periods extending to 3 months for House–Brackmann outcomes. Quantitative data were expressed as mean $\pm$ standard deviation; differences were considered significant at $p < 0.05$.

Results

At baseline, the total cohort had no House–Brackmann I–II cases; grade III predominated, and grade V was present in 19.4%. By the third month, House–Brackmann I–II recovery was achieved in 88.6% of patients in the 1 Hz group, 91.9% in the 10 Hz group and 61.3% in the control group. Thus, both rTMS strategies outperformed conventional therapy, while the 10 Hz protocol showed the



best distribution toward mild or normal function. Sunnybrook scores increased from 34.70 ± 8.33 to 69.43 ± 11.35 in the 10 Hz group, corresponding to approximately 100% improvement. The 1 Hz group improved from 32.03 ± 9.63 to 58.14 ± 13.85 , while the control group improved from 28.23 ± 10.25 to 39.13 ± 12.17 . Yanagihara scores followed a similar gradient: 16.30 ± 5.00 to 31.19 ± 5.02 in the 10 Hz group, 15.89 ± 5.23 to 25.26 ± 7.59 in the 1 Hz group and 15.97 ± 4.45 to 20.87 ± 5.27 in controls. All within-group changes were significant ($p < 0.05$).

Discussion

The results support a frequency-dependent effect of rTMS on facial motor recovery. High-frequency stimulation is physiologically expected to enhance excitability of motor networks, which may explain the more pronounced improvement in Sunnybrook and Yanagihara scores. The clinical pattern is also consistent with earlier observations that rTMS can facilitate recovery in facial palsy [3,4]. The practical value of 10 Hz rTMS is not limited to score improvement. Faster shift from moderate or severe paresis toward grade I–II function may reduce cosmetic disability, improve social communication and shorten the rehabilitation pathway. The 1 Hz protocol remains useful, especially when inhibitory modulation is needed, but in patients requiring rapid motor activation the 10 Hz protocol appears preferable.

Conclusion

High-frequency 10 Hz rTMS added to conventional therapy demonstrated the strongest functional recovery in facial nerve neuropathy. Its superiority was evident across House–Brackmann, Sunnybrook and Yanagihara outcomes, making it a rational first-choice neuromodulatory protocol for patients in the active recovery stage.

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