IMMUNOINFLAMMATORY RESPONSE TO RTMS IN FACIAL NERVE NEUROPATHY: DYNAMICS OF IL-6, IL-10 AND C-REACTIVE PROTEIN

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Abstract

Objective: To analyze the immunobiochemical response to different rTMS frequencies in facial nerve neuropathy. Methods: IL-6, IL-10 and C-reactive protein (CRP) were compared before and after treatment in patients receiving 1 Hz rTMS, 10 Hz rTMS or conventional therapy. Results: The strongest decrease in IL-6 and CRP and the most pronounced increase in IL-10 occurred in the 10 Hz group. Conclusion: High-frequency rTMS appears to modulate the inflammatory–regenerative balance in facial nerve neuropathy and may be useful when inflammatory activity is clinically relevant.

Keywords: *IL-6; IL-10; CRP; neuroinflammation; facial palsy; repetitive transcranial magnetic stimulation*

Introduction

Inflammation and immune regulation are essential elements in peripheral nerve injury. In facial nerve neuropathy, endoneural edema, local demyelination, axonal dysfunction and inflammatory mediators may influence the pace and completeness of recovery. Contemporary reviews of Bell's palsy emphasize the importance of early diagnosis, corticosteroid-based treatment and identification of patients at risk of delayed recovery [1,2]. The biological rationale for rTMS is not limited to cortical excitability. Experimental and clinical observations suggest that non-invasive brain stimulation may interact with neuroimmune pathways, neuroplasticity and tissue repair [3,4]. In the dissertation dataset, IL-6, IL-10 and CRP were measured as markers of proinflammatory activity, anti-inflammatory compensation and systemic inflammatory response. This article analyzes these markers as a separate immunological endpoint.

Materials and Methods

The final cohort consisted of 103 patients with peripheral facial nerve neuropathy. Patients were divided into three treatment groups: conventional therapy plus 1 Hz rTMS (n=35), conventional therapy plus 10 Hz rTMS (n=37) and conventional therapy alone (n=31). Blood markers were assessed before and after

treatment. IL-6 was interpreted as a proinflammatory marker associated with local neurovascular edema and recovery delay. IL-10 was used as an indicator of anti-inflammatory regulation. CRP reflected systemic inflammatory activity. Group comparisons focused on relative dynamics and clinical interpretation.

Results

Before treatment, the total cohort had IL-6 of 8.8 ± 2.6 pg/mL, IL-10 of 4.55 ± 1.19 pg/mL and CRP of 5.99 ± 2.46 mg/L. In the 10 Hz group, IL-6 decreased from 9.18 ± 2.79 to 6.11 ± 3.16 pg/mL, corresponding to a 33.4% reduction. The 1 Hz group decreased from 7.86 ± 2.21 to 5.88 ± 2.44 pg/mL, while the control group changed only from 9.42 ± 3.02 to 8.76 ± 3.35 pg/mL. IL-10 rose most prominently in the 10 Hz group: from 4.27 ± 1.25 to 5.77 ± 1.28 pg/mL. This represented a stronger anti-inflammatory shift than in the 1 Hz group, where IL-10 increased from 4.60 ± 1.14 to 5.55 ± 1.27 pg/mL, and the control group, where the change was modest. CRP decreased from 6.30 ± 2.55 to 4.48 ± 2.63 mg/L under 10 Hz rTMS, compared with 5.66 ± 2.80 to 4.42 ± 2.59 mg/L under 1 Hz rTMS and 6.13 ± 2.02 to 5.67 ± 2.04 mg/L in controls.

Discussion

The immunological profile suggests that high-frequency rTMS may support recovery not only by activating motor circuits but also by influencing the inflammatory milieu. The marked IL-6 reduction is important because the dissertation analysis identified IL-6 as a marker correlated with clinical severity. A decrease in CRP supports a parallel systemic anti-inflammatory trend, while IL-10 growth may reflect strengthened compensatory immune control.

This does not mean that rTMS replaces etiological or anti-inflammatory treatment. Rather, 10 Hz rTMS may be used as a rehabilitation amplifier in patients with elevated inflammatory markers. Such an approach would make patient selection smarter: not just “who has facial palsy,” but “who has a biological profile that may benefit from earlier neuromodulation.” That is medicine going from vibes to biomarkers — finally.

Conclusion

In facial nerve neuropathy, 10 Hz rTMS produced the most favorable immunobiochemical dynamics: IL-6 and CRP decreased more strongly, while IL-10 increased more clearly than in other groups. These changes support the use of immune markers for selecting and monitoring patients undergoing rTMS-based rehabilitation.

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