Biomechanical Evaluation before and after Repetitive Transcranial Magnetic Stimulation (rTMS) in a Patient with Atypical Parkinsonism (Suspected MSA): Case Report

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Abstract

Introduction: Atypical parkinsonism, including Multiple System Atrophy (MSA), is characterized by postural instability, high risk of falls, and refractoriness to conventional treatments. Repetitive transcranial magnetic stimulation (rTMS) has been investigated as an adjuvant strategy for motor symptoms in parkinsonian syndromes. Wearable sensor technologies allow objective gait quantification, providing reproducible measures for intervention assessment.
Clinical description: A 63-year-old woman with a clinical diagnosis of atypical parkinsonism, under investigation for MSA. The protocol included rTMS applied for five consecutive days (July 21–25, 2025), in two daily sessions (10 sessions in total): - Left dorsolateral prefrontal cortex (F3): 10 Hz, 1800 pulses/session. - Supplementary motor area (SMA): 10 Hz, 3000 pulses/session. - Spinal stimulation: 50 Hz, 20 pulses, 20 series, 2-second intervals between series. Each session was followed by neurofunctional physiotherapy focused on gait and balance. Assessments included gait analysis with an inertial sensor (Baiobit®, Sensor Medica, Italy), extracting spatiotemporal parameters (velocity, cadence, step length, symmetry, and propulsion), as well as the standardized Timed Up and Go (TUG) test.
Discussion: Following the intervention, significant clinical and functional improvements were observed. In the TUG, fall risk decreased from high (pre) to low (post), and functional independence improved from semi-independent to independent. Gait analysis demonstrated improvements in symmetry (0 → 85%), cadence (+88.7%), and propulsion (0 → 10). Velocity increased (3.3 → 5.9 m/s; +78.8%), while step length remained slightly reduced (-3.2%), suggesting a cautious gait pattern. These findings reinforce evidence supporting the benefits of rTMS in movement disorders and highlight the role of wearable sensors in providing objective clinical outcomes. Even in non-idiopathic parkinsonian syndromes, neuromodulation may contribute to functional improvement and gait safety.
Conclusions: The rTMS protocol combined with neurofunctional physiotherapy resulted in objective improvements in gait and reduced fall risk in a patient with atypical parkinsonism (suspected MSA). This case highlights the potential of neuromodulation as a symptomatic therapeutic resource in refractory parkinsonian syndromes.

References

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