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Examining the Effectiveness of Infra-Low Frequency Neurofeedback on Cognitive and Clinical Components and Brain Signals in Patients with Parkinson's Disease

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1. Round 1

1.1. Reviewer 1

Reviewer:

The inclusion criteria state "absence of dementia, absence of severe depression", yet no standardized diagnostic tools are reported for screening these conditions; the authors must specify which instruments or clinical procedures were used to confirm these criteria to ensure methodological rigor.

In the instruments section, the description "RehaCom software… includes exercises aimed at improving attention, spatial processing, and executive functioning" lacks psychometric justification; the authors should provide validity and reliability evidence for the specific modules used, especially in Parkinson's populations.

Regarding the UPDRS, the statement "The maximum possible score on the scale is 195" is correct but incomplete; the authors should specify which version (UPDRS vs. MDS-UPDRS) was used, as this has implications for comparability and interpretation.

In Table 2, the statement “data… showed a normal distribution” based on Shapiro–Wilk tests is questionable with such a small sample; the authors should acknowledge the limited reliability of normality testing with n=5.

The RehaCom results include extreme values such as “0.01% (Z = -5.00)” across multiple participants and phases; this suggests potential floor effects or scoring artifacts, which should be critically discussed.

Authors revised and uploaded the document.

1.2. Reviewer 2

Reviewer:

In the MoCA description, the sentence “Individuals scoring 25 or higher are considered cognitively normal” is overly simplified; the cutoff varies by education and population, and the authors should justify the selected cutoff for Parkinson’s disease specifically.

The EEG methodology includes “electrode impedance was maintained below 5 kΩ”, but no details are provided on artifact rejection, preprocessing pipeline, or referencing scheme; these are critical for EEG validity and must be elaborated.

In the neurofeedback protocol, the statement “The optimal reinforcement frequency… was determined based on the patient’s subjective reports” introduces subjectivity; the authors should clarify whether any objective criteria or standardized protocol guided frequency optimization.

The sentence “Training began at a frequency of 0.1 mHz” requires clarification, as this value is extremely low and may reflect a misunderstanding of infra-low frequency ranges; units and operational definitions must be verified and explained.

In the data analysis section, the use of “paired-samples t-test” and “ANOVA” with n=5 violates assumptions of normality and statistical power; the authors should consider nonparametric alternatives or single-case analysis methods (e.g., visual analysis, Tau-U).

Authors revised and uploaded the document.

2. Revised

Editor’s decision after revisions: Accepted.

Editor in Chief’s decision: Accepted.

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