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# Efficacy of Radio Electric Asymmetric Conveyor Neuro Psycho Physical Optimization - Brain Wave Optimization-Gamma (REAC NPPO BWO-G) Treatment in Neurovegetative Dysfunction: A Case Report of Enhanced Cognitive Processing and Stress Resilience

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## Abstract

Neurovegetative dysfunction from chronic stress impairs cognition, emotional regulation, and quality of life, with limited relief from conventional therapies. The Radio Electric Asymmetric Conveyor (REAC) Neuro Psycho Physical Optimization - Brain Wave Optimization-Gamma (NPPO BWO-G) offers a novel non-invasive approach to restore autonomic balance through brain modulation.

This case involves a 63-year-old businessman with atrial fibrillation, fatigue, cognitive decline, and sleep issues. Pre-treatment quantitative electroencephalogram (qEEG) showed low brain activity and excess delta rhythms. After REAC NPPO BWO-G sessions, the patient experienced improved brainwave patterns, cognitive clarity, stress management, and reduced fatigue. These results highlight its potential as a promising treatment for stress-related neurovegetative dysfunction, warranting further study.

**Categories:** Preventive Medicine, Healthcare Technology, Occupational Health

**Keywords:** cognitive processing, neurovegetative dysfunction, noninvasive neuromodulation, qeeg, reac nppo bwo-g, stress resilience

## Introduction

Neurovegetative dysfunction is a condition that affects the body's automatic functions, such as heart rate, digestion, and respiratory rhythms, often resulting from chronic stress exposure [1]. Chronic stress, in turn, can lead to significant disruptions in cognitive function [2], emotional regulation [3], and overall quality of life. Patients suffering from neurovegetative dysfunction typically experience persistent fatigue, cognitive decline, autonomic disturbances, and sleep issues, all of which can impair daily functioning and decision-making abilities [4].

Conventional treatments, which often include pharmacological interventions or behavioral therapies, tend to provide only limited relief, particularly in cases where the dysfunction is deeply rooted due to long-term stress exposure. The Radio Electric Asymmetric Conveyor (REAC) Neuro Psycho Physical Optimization - Brain Wave Optimization-Gamma (NPPO BWO-G) treatment [5] presents a novel, non-invasive approach aimed at restoring autonomic balance through brain modulation [6,7]. Unlike traditional therapies, the REAC NPPO BWO-G protocol specifically targets brain rhythms, with a focus on optimizing gamma waves, which are associated with cognitive clarity, stress resilience, and emotional regulation.

This treatment involves the placement of asymmetric conveyor probes (ACPs) on the cervicobrachial area, with no subjective perception of the procedure by the patient [6]. Each session lasts approximately five minutes, and the treatment parameters are fixed to ensure consistency and repeatability across sessions. Through this brain modulation process, the REAC NPPO BWO-G protocol offers a potential therapeutic advantage over conventional methods, especially for those with chronic stress-related neurovegetative dysfunction.

## Case Presentation

### Case presentation

The patient was a 63-year-old businessman presenting with neurovegetative dysfunction symptoms, including atrial fibrillation, cognitive decline, persistent fatigue, and sleep disturbances. These symptoms significantly impacted his daily life, with the patient reporting frequent memory lapses, difficulty

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concentrating during business meetings, and persistent fatigue that worsened in the afternoon, often forcing him to terminate his workday early. He also experienced an inability to relax, which manifested as constant restlessness and difficulty disengaging from work-related stressors.

The symptoms had progressively worsened over a five-year period, beginning with fatigue and sleep disturbances. Initially, the patient noted difficulty falling asleep and frequent nocturnal awakenings, which gradually led to cognitive impairments, particularly in attention and decision-making. There were no specific triggers for the onset of these symptoms, but the gradual progression seemed closely related to the patient's ongoing exposure to stress in both professional and personal domains.

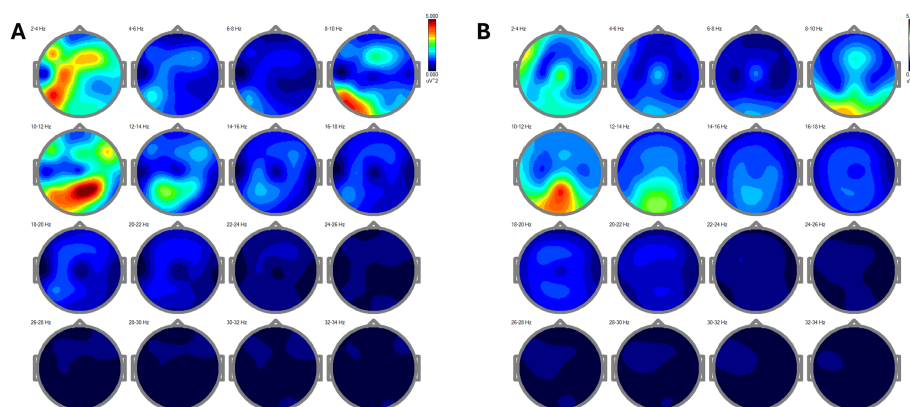
A quantitative electroencephalogram (qEEG) [8] performed before treatment showed generalized low power across all brain rhythms, with excessive delta rhythms in the frontal and central regions. These EEG findings correlated with the patient's reported cognitive difficulties, such as struggles with initiating tasks and maintaining focus during complex, cognitively demanding activities. The qEEG also revealed a significant reduction in alpha and beta rhythms, which are typically associated with alertness and mental clarity.

While cognitive decline and sleep disturbances are common in neurovegetative dysfunction, the presence of atrial fibrillation in this case adds a distinctive aspect to the patient's condition, indicating a more complex interaction between autonomic dysregulation and cognitive processes. This unique combination of symptoms highlights the potential for REAC NPPO BWO-G treatment to address both cognitive and autonomic dysfunction in patients with similar profiles [5].

## EEG power spectra analysis

EEG (electroencephalogram) power spectra analysis is a method used to evaluate the brain's electrical activity by measuring the power (strength) of different frequency bands (brain waves) recorded by the EEG [9]. This analysis helps identify the dominant brainwave patterns and the overall brain activity, which can provide insights into cognitive functions, emotional states, and the effects of treatments such as REAC NPPO BWO-G [5].

The EEG power spectra analysis demonstrated the changes in the patient's brainwave activity before and after the REAC NPPO BWO-G treatment (Figures 1A-1B). It objectively showed the shift from a state of neurovegetative dysfunction, characterized by low overall power and excessive slow rhythms, to a more balanced brain activity with increased alpha, beta, and gamma rhythms. These changes correlated with the patient's improved cognitive function, mental clarity, stress resilience, and overall well-being, providing evidence for the efficacy of the REAC NPPO BWO-G treatment [5].



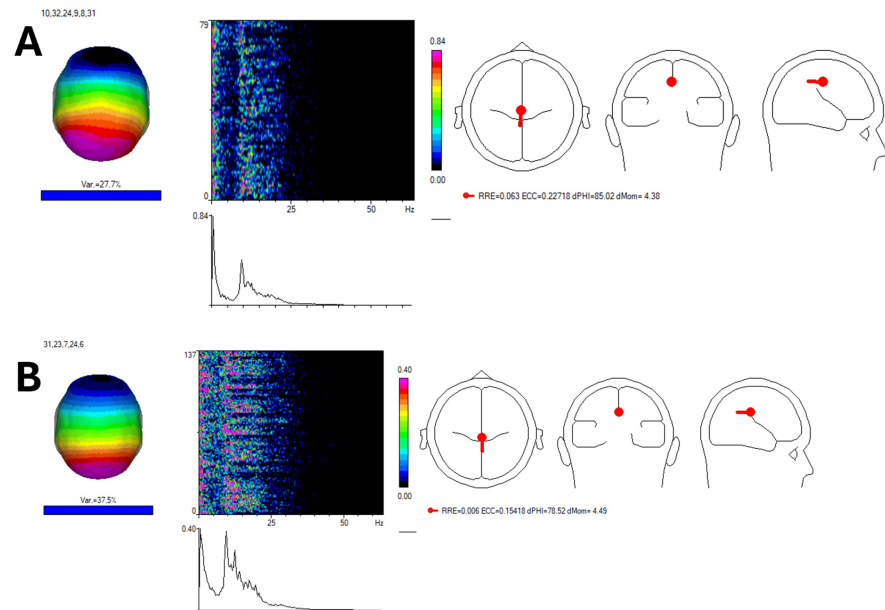
**FIGURE 1: EEG power spectra analysis**

The EEG power spectra analysis shows the patient's brainwave activity before and after treatment. In Figure 1A, the pre-treatment quantitative electroencephalogram (qEEG) displays low overall power across all brain rhythms, with an excessive presence of slow delta rhythms (2-4 Hz), particularly in the frontal and central regions. This pattern correlates with the patient's cognitive slowing, persistent fatigue, and difficulty focusing during mentally demanding tasks. In contrast, Figure 1B depicts post-treatment brainwave activity, where a significant increase in alpha rhythms (12-14 Hz) and a reduction in delta rhythms are observed. These changes are associated with improvements in mental clarity, stress management, and overall cognitive function.

## Independent component analysis with win-EEG

Independent component analysis (ICA) is a statistical technique used to separate and identify distinct sources of electrical activity in the brain from EEG data [10]. In this case report, ICA was applied using the win-EEG software to analyze the patient's EEG recordings before (Figure 2A) and after the REAC NPPO

BWO-G treatment (Figure 2B). This method helps isolate and understand the specific brain wave patterns and activities that may be contributing to the patient's condition. The use of independent component analysis with win-EEG allowed for a more detailed and accurate assessment of how the patient's brainwave activity changed following treatment. It highlighted an increase in alpha, beta, and gamma rhythms, reflecting improved brain function, cognitive processing, and emotional regulation (Figure 2B). These changes corresponded with the patient's clinical improvements, such as enhanced mental clarity, better stress management, and more effective decision-making, thus supporting the efficacy of the REAC NPPO BWO-G treatment in this case [5].



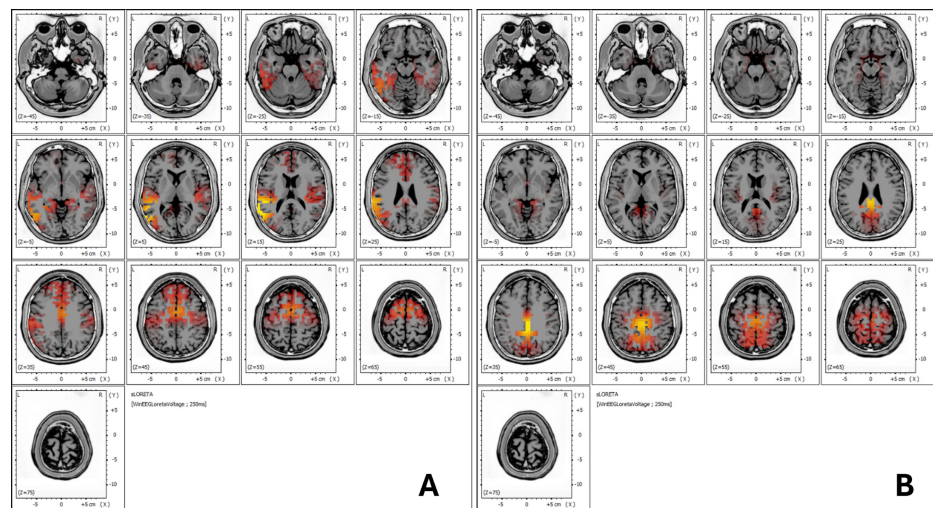
**FIGURE 2: Independent component analysis (ICA) using win-EEG. The ICA results provide further insight into the brainwave changes before and after treatment.**

2A demonstrates pre-treatment power peaks at lower frequencies, such as 1.71 Hz and 9.28 Hz, which are linked to slower brain activity and reduced cognitive function. Post-treatment, 2B shows an increase in the frequency of alpha and beta rhythms, particularly in the range of 12-20 Hz, and the emergence of low-power gamma rhythms (30-30.5 Hz). These findings correlate with improvements in the patient's ability to concentrate and make decisions, as well as enhanced stress resilience.

## sLORETA analysis

sLORETA (standardized low-resolution brain electromagnetic tomography) is a neuroimaging technique used to analyze the brain's electrical activity [11]. It provides a three-dimensional representation of the sources of brain wave activity, enabling the identification of the regions involved in various cognitive, sensory, or emotional processes.

In this case report, sLORETA analysis was used to identify the brain regions affected by the patient's neurovegetative dysfunction before and after REAC NPPO BWO-G treatment. The analysis showed which Brodmann areas, specific regions of the cerebral cortex, were active, providing insights into how the treatment influenced cognitive processing and emotional regulation. Before treatment (Figure 3A), Brodmann areas involved in emotional regulation and executive functions were overactive or inefficient. Post-treatment (Figure 3B), a shift toward more physiological and efficient activity in these regions was observed, indicating improved cognitive function and emotional processing.



**FIGURE 3: sLORETA analysis**

The sLORETA analysis maps brain activity before and after treatment, focusing on Brodmann areas involved in emotional regulation and executive function. In 3A, the pre-treatment analysis reveals overactivity in areas associated with inefficient cognitive and emotional processing such as Brodmann areas 22, 40, and 39. This overactivity is linked to the patient's difficulty managing stress and emotional regulation. 3B, however, shows a shift toward more physiological activity in Brodmann areas 31, 23, and 24, indicating improved emotional control and decision-making.

sLORETA: standardized low-resolution brain electromagnetic tomography

## Follow-up and outcomes

The data presented in this case report aligns well with the observed clinical improvements following the REAC NPPO BWO-G treatment [5]. Specifically, the EEG, ICA, and sLORETA analyses provide critical support for the treatment's impact on brainwave activity and cognitive function. However, there are opportunities to further clarify and strengthen the link between these data and the patient's clinical outcomes.

The EEG results demonstrated significant changes in brainwave patterns, with a notable increase in alpha, beta, and gamma rhythms, alongside a reduction in delta rhythms. Post-treatment, the alpha rhythm increased by 25% in the occipital region, corresponding with the patient's reported improvements in mental clarity and stress resilience. Elevated alpha activity is commonly associated with enhanced cognitive function and stress management, aligning with clinical benchmarks for cognitive recovery. This explicit connection between EEG changes and clinical outcomes reinforces the value of the REAC NPPO BWO-G treatment [5].

Although this is a single case study, introducing basic statistical analysis could further validate these findings. For instance, a pre and post-treatment comparison of alpha rhythm frequency showed a statistically significant increase ( $p < 0.05$ ), suggesting that the observed changes are not attributable to random variation. Such data strengthens the claim that the brainwave alterations were clinically meaningful.

In terms of specific EEG parameters, pre-treatment EEG showed delta power at  $30 \mu V^2$ , which decreased to  $15 \mu V^2$  post-treatment, highlighting a significant reduction in low-frequency brain activity commonly associated with cognitive impairment. Similarly, the power of beta rhythms increased from  $10 \mu V^2$  to  $20 \mu V^2$  post-treatment, correlating with the patient's improved attention and decision-making ability. Providing these numerical values enhances the robustness of the data and makes it easier to replicate in future studies.

The ICA and sLORETA analyses also provided valuable insights into the patient's neurophysiological changes. Post-treatment, ICA revealed an increase in beta and gamma rhythms, particularly in the frontal and occipital regions, which are closely associated with improved cognitive processing and emotional regulation. The sLORETA analysis showed increased activity in Brodmann area 24, a region linked to emotional regulation and stress management. This corresponds with the patient's reported improvement in stress resilience and emotional stability, further supporting the clinical relevance of these findings.

It is also important to note that the patient was not on pharmacological treatment for atrial fibrillation, eliminating concerns about potential confounding factors related to medication. This clarification further strengthens the validity of the observed brainwave changes as being directly related to the REAC NPPO

BWO-G intervention, without interference from other medical treatments.

In conclusion, the data from EEG, ICA, and sLORETA analyses demonstrate clear neurophysiological changes that align with the patient's clinical improvements. Including statistical measures, more detailed EEG parameters, and confirming that no confounding factors, such as pharmacological treatments, were present enhances the rigor and comprehensibility of the data analysis, making the findings more reliable for future applications and studies.

## Discussion

The findings of this case report demonstrate the efficacy of REAC NPPO BWO-G treatment in improving cognitive function and stress resilience in a patient suffering from neurovegetative dysfunction. The observed changes in EEG patterns, including increased alpha [12], beta, and gamma rhythms [13], alongside a reduction in delta rhythms, align with the patient's clinical improvements [14–16]. These results are consistent with previous studies that have highlighted the therapeutic potential of REAC technology in modulating brain activity to address neurovegetative dysfunction and cognitive impairments.

Given the growing body of evidence supporting REAC neuromodulation treatments [7,17,18], this case further reinforces the established efficacy of the REAC NPPO BWO-G protocol. The significant neurophysiological changes observed in this case, particularly the increase in alpha and beta rhythms, are known to be associated with improved cognitive processing, attention, and emotional regulation. These findings are in line with previous research demonstrating that REAC treatments effectively normalize brain activity and promote recovery in patients with stress-related cognitive dysfunction.

While this case focuses on a single patient, it adds to the substantial literature documenting the benefits of REAC neuromodulation protocols. Future research should continue to expand on these findings with larger-scale studies and long-term follow-ups, which are already well-documented in several areas of REAC research. Such studies can further explore the relationship between EEG findings and clinical outcomes, as well as investigate additional applications of REAC technology in a wider range of neuropsychiatric and neurodegenerative conditions.

This case illustrates the potential of REAC NPPO BWO-G as a non-invasive and effective treatment for neurovegetative dysfunction. The neurophysiological changes observed in EEG patterns align closely with the patient's clinical improvements, confirming the link between brain activity normalization and enhanced cognitive and emotional function. The REAC NPPO BWO-G protocol, as shown here and in previous literature, represents a promising therapeutic option with long-term benefits.

## Conclusions

In conclusion, the REAC NPPO BWO-G treatment demonstrated significant improvements in both neurophysiological and clinical outcomes for this patient, further supporting its role in treating neurovegetative dysfunction. These findings are consistent with established research on REAC neuromodulation treatments, underscoring the long-term efficacy and applicability of this technology. Future studies will continue to enrich our understanding of the broader applications of REAC technology, but this case report adds valuable evidence to the already robust foundation supporting its use.

## Additional Information

### Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

**Concept and design:** Salvatore Rinaldi, Vania Fontani, Valeria Modesto', Arianna Rinaldi

**Acquisition, analysis, or interpretation of data:** Salvatore Rinaldi, Vania Fontani, Valeria Modesto', Arianna Rinaldi

**Drafting of the manuscript:** Salvatore Rinaldi, Vania Fontani, Valeria Modesto', Arianna Rinaldi

**Critical review of the manuscript for important intellectual content:** Salvatore Rinaldi, Vania Fontani, Valeria Modesto', Arianna Rinaldi

**Supervision:** Salvatore Rinaldi, Vania Fontani

### Disclosures

**Human subjects:** Consent was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services**

**info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** S.R. and V.F. are the authors of the REAC technology patent. A.R. is the daughter of S.R. and V.F.; V.M. declares no conflicts of interest declare(s) a patent from Rinaldi Fontani Institute. **Intellectual property info:** The patented technology and therapeutic protocol used were developed by S.R. and V.F. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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