Neurophysiological Effects of Inner Organic technology (IOTA) based programs

A Resting-State EEG White Paper Investigating Executive Network Organization, Default Mode Network Dynamics, Functional Connectivity, and Aperiodic Cortical Activity

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Abstract

The activation of Inner Organic Technology® is designed to support psychological well-being through interventions intended to promote nervous system flexibility and adaptive functioning. Although participants frequently report improvements in emotional resilience, mental clarity, stress tolerance, and overall well-being, relatively little published research has examined the neurophysiological changes that may accompany these experiences.

This investigation examined resting-state, eyes-closed electroencephalographic (EEG) recordings obtained before and after participation in an IOTA-based multimodal intervention. Artifact-cleaned EEG recordings from 20 pre-intervention and 20 post-intervention participants were analyzed, including a matched subgroup of 15 individuals who completed both assessments. Analyses focused on spectral power, functional connectivity, executive network organization, default mode network (DMN) dynamics, and aperiodic (1/f) cortical activity.

The primary finding was a statistically significant reduction in executive-network theta-band weighted Phase Lag Index (wPLI) connectivity following the intervention. Exploratory analyses also identified trends toward reduced posterior broadband cortical activity, lower occipital aperiodic offset, and modest increases in DMN-related alpha clustering, although these findings did not remain statistically significant following correction for multiple comparisons.

Taken together, these findings suggest that IOTA based programs may be associated with measurable alterations in large-scale resting-state brain organization. While preliminary, the observed changes are consistent with contemporary models of neural efficiency and large-scale network regulation and support further investigation using larger samples and multimodal outcome measures.

Keywords: Inner Organic Technology®, quantitative EEG, executive network, default mode network, functional connectivity, weighted Phase Lag Index, neural efficiency, aperiodic activity

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Executive Summary

IOTA based programs are integral based approachs designed to enhance and evolve psychological well-being through interventions that support nervous system regulation and personal growth. Although many participants report meaningful improvements in emotional regulation, resilience, mental clarity, and quality of life, objective investigations of the underlying neurophysiological mechanisms remain limited.

This white paper summarizes findings from a pilot EEG investigation examining resting-state brain activity before and after participation in an IOTA-based intervention that included HBL and associated supportive technologies. Resting-state, eyes-closed EEG recordings were analyzed using measures of spectral power, functional connectivity, executive network organization, default mode network dynamics, and aperiodic (1/f) cortical activity.

The most robust finding was a significant reduction in theta-band functional connectivity within the executive-control network, measured using weighted Phase Lag Index (wPLI). Because wPLI minimizes the influence of volume conduction and zero-lag synchronization, it provides a conservative estimate of communication among distributed cortical regions (Vinck et al., 2011). This finding suggests that executive brain regions required less synchronized communication during resting-state conditions following the intervention.

Additional trends included reductions in posterior cortical activity, lower occipital aperiodic offset, and modest changes in default mode network organization. Although these secondary findings should be considered exploratory, their direction was generally consistent across participants and aligned with contemporary theories of neural efficiency and intrinsic brain network regulation (Donoghue et al., 2020; Neubauer & Fink, 2009).

Importantly, this study did not evaluate subjective experiences or clinical outcomes directly. Therefore, while the observed neurophysiological changes are consistent with experiences frequently reported following IOTA—including greater mental clarity, improved emotional regulation, and a quieter internal dialogue—these relationships remain theoretical and should be examined in future studies that include validated psychological outcome measures.

Overall, the present findings provide preliminary neurophysiological evidence supporting continued investigation of IOTA based programs as an integral approach to nervous system regulation and psychological well-being.

Introduction

Background

Over the past two decades, advances in neuroscience have increasingly shifted the understanding of brain function from isolated cortical regions toward the coordinated activity of large-scale neural networks. Rather than functioning independently, distributed brain regions continually communicate to support attention, emotional regulation, self-awareness, decision-making, and adaptive behavior (Bassett & Sporns, 2017; Menon, 2011). Resting-state electroencephalography (EEG) provides a valuable method for examining these large-scale interactions because it captures spontaneous neural activity while the brain is not engaged in a specific task.

Three intrinsic brain networks have received particular attention in contemporary neuroscience. The **Executive Control Network (ECN)** supports goal-directed behavior, cognitive flexibility, working memory, and attentional regulation. The **Default Mode Network (DMN)** is associated with internally directed cognition, autobiographical memory, self-referential processing, and mind wandering (Buckner et al., 2008). The **Salience Network (SN)** is thought to facilitate switching between internally and externally directed attention by coordinating communication between the executive and default mode networks (Menon & Uddin, 2010).

Increasing evidence suggests that psychological health depends not only on the integrity of these individual networks but also on the efficiency with which they communicate and dynamically reorganize in response to changing internal and external demands (Menon, 2011). Alterations in these large-scale networks have been reported across numerous conditions, including depression, anxiety, chronic stress, trauma, and various contemplative practices (Brewer et al., 2011; Lutz et al., 2008).

Hinner Organic Technology (IOTA) based programs

IOTA based programs are designed to promote nervous system regulation through gentle manual stimulation and contemplative supportive technologies intended to facilitate adaptive psychological functioning. Clinically, participants commonly report improvements in emotional resilience, reduced stress, greater mental clarity, enhanced interpersonal functioning, and increased overall well-being. Although these reports have been consistent across many practitioners, relatively few investigations have examined the neurophysiological correlates of these experiences.

Rather than focusing exclusively on symptom reduction, IOTA is intended to promote positive adaptation, an increased capacity for self-regulation and an evolution of consciousness. This emphasis is conceptually consistent with emerging perspectives in neuroscience suggesting that interventions supporting nervous system flexibility may influence large-scale brain organization rather than isolated cortical regions (Bassett & Sporns, 2017).

The present investigation examined IOTA programs as is typically delivered in practice. Consequently, the findings should be interpreted as reflecting the combined interventions rather than the isolated effects of any single IOTA programs component.

Resting-State EEG and Neural Efficiency

Traditional quantitative EEG research has emphasized changes in oscillatory power within conventional frequency bands such as delta, theta, alpha, beta, and gamma. More recent work, however, has demonstrated that resting-state brain function also reflects changes in large-scale functional connectivity and the aperiodic background component of the EEG signal (Donoghue et al., 2020).

One contemporary framework relevant to the present findings is the Neural Efficiency Hypothesis, which proposes that more efficient neural systems may require less activation or coordination to accomplish similar functional outcomes (Neubauer & Fink, 2009). Within this framework, reductions in resting-state activity or functional connectivity do not necessarily indicate diminished function. Instead, they may reflect improved efficiency of large-scale neural communication, particularly when accompanied by maintained or improved behavioral functioning.

Similarly, studies of contemplative practices have reported alterations in communication among executive, default mode, and salience networks, often accompanied by reductions in self-referential thinking, improved attentional regulation, and enhanced emotional flexibility (Brewer et al., 2011; Lutz et al., 2008). These observations provide a useful framework for interpreting neurophysiological changes associated with interventions intended to promote self-regulation and psychological well-being.

Relationship to Previous Research

The present study extends previous investigations examining neurophysiological correlates of transformative psychological experiences. In a source-localized EEG investigation using standardized weighted low-resolution electromagnetic tomography (swLORETA), Ooms (2024) reported significant alterations in executive-network lagged coherence associated with profound mystical experiences during an IOTA based program Although the present investigation examined longitudinal resting-state changes following an IOTA-based intervention rather than acute altered states of consciousness, both studies implicate executive-network organization as a potentially important neurophysiological mechanism underlying transformative psychological processes.

Unlike the previous investigation, which focused primarily on source-localized connectivity during meditation, the present study examined resting-state functional organization before and after an intervention using spectral power, weighted Phase Lag Index connectivity, and aperiodic EEG measures. Together, these complementary approaches contribute to an emerging understanding of how interventions intended to enhance psychological well-being may influence large-scale brain organization.

Purpose of the Present Study

The purpose of this investigation was to examine whether participation in IOTA based program was associated with measurable changes in resting-state brain organization. Specifically, the study evaluated changes in executive-network functional connectivity, default mode network dynamics, spectral power, and aperiodic cortical activity using artifact-cleaned resting-state EEG recordings.

Based on previous findings from contemplative neuroscience and the author's earlier work on executive-network organization (Ooms, 2024), it was hypothesized that participation in the intervention would be associated with measurable alterations in large-scale cortical communication, particularly within networks involved in cognitive regulation and intrinsic brain organization.

Methods and Results

Methods

Study Design

This study used a pre/post observational design to examine resting-state EEG differences associated with participation in IOTA based programs. Because the available dataset included both matched and unmatched recordings, two analytic approaches were used. First, all available pre-condition and post-condition recordings were compared as independent groups. Second, participants with clearly matched pre- and post-condition EEG files were analyzed using repeated-measures comparisons.

The matched repeated-measures analysis was considered the primary analysis because it provides stronger control for individual differences in baseline EEG characteristics.

EEG Dataset

Participants

Forty resting-state EEG recordings were included in the present analyses, consisting of 20 pre-intervention recordings and 20 post-intervention recordings. Fifteen participants completed both pre- and post-assessments and were included in matched repeated-measures analyses.

Participant demographic characteristics, clinical diagnoses, and symptom severity were not available for the present analyses. Consequently, the study should be considered an exploratory neurophysiological investigation rather than a clinical efficacy trial.

Recordings were acquired using CGX, Deymed TruScan, and NeuroField Q21 EEG systems. Sampling rates varied across files and included 128 Hz, 250 Hz, and 256 Hz. Each file was analyzed according to its actual sampling rate.

All recordings were artifact-cleaned through NeuroGuide prior to EDF export. The present analysis used the cleaned eyes-closed EDF files.

EEG Measures

The analysis examined four primary domains of resting-state EEG organization:

1. Spectral power by region and frequency band.
2. Aperiodic activity, including 1/f slope and offset.
3. Functional connectivity using weighted Phase Lag Index (wPLI) and coherence.
4. Network-level graph metrics for executive-control, default mode proxy, and salience proxy networks.

Weighted Phase Lag Index was emphasized because it reduces the influence of volume conduction and zero-lag synchronization, making it more conservative than conventional coherence for estimating functional connectivity among distributed cortical regions (Vinck et al., 2011).

Network Definitions

The executive network was modeled using frontal and frontoparietal scalp regions associated with executive regulation. The default mode network was modeled using scalp-level proxy regions corresponding approximately to internally oriented cortical organization. Because scalp EEG does not directly measure deep cortical default mode structures such as the posterior cingulate cortex or medial prefrontal cortex, the DMN findings should be interpreted as proxy measures rather than direct source-localized DMN activity.

Statistical Analysis

Matched pre/post analyses used paired-samples comparisons. Independent pre/post analyses used independent group comparisons. False discovery rate correction was applied to reduce the likelihood of false-positive findings across multiple comparisons (Benjamini & Hochberg, 1995). Findings that survived FDR correction were treated as the primary results. Uncorrected findings were treated as exploratory trends.

Effect sizes were reported as Cohen’s dz for matched analyses and Hedges’ g for independent group comparisons.

Results

Data Quality and Sample Characteristics

All 40 EDF files were readable and suitable for analysis after artifact cleaning. The full dataset included 20 pre-condition and 20 post-condition recordings. Fifteen participants had matched pre/post files and were included in the primary repeated-measures analyses.

Because the dataset was collected using multiple EEG acquisition systems and sampling rates, findings should be interpreted as preliminary and should be replicated in a larger, prospectively controlled sample.

Primary Finding: Executive Network Theta wPLI

The strongest and most statistically reliable finding was a reduction in theta-band weighted Phase Lag Index connectivity within the executive network among the 15 matched participants.

Executive theta wPLI network strength decreased from a pre-condition mean of 3.96 to a post-condition mean of 3.39. This represented a mean reduction of 0.58, or approximately 14.59%. The effect was statistically significant, $t(14) = -3.98$, $p = .001$, Cohen's $dz = -1.03$, and remained significant after FDR correction, $q = .033$.

Executive theta wPLI global efficiency decreased from 0.71 pre-condition to 0.62 post-condition. This represented a mean reduction of 0.09, or approximately 12.82%. This effect was also statistically significant, $t(14) = -4.26$, $p < .001$, Cohen's $dz = -1.10$, and remained significant after FDR correction, $q = .033$.

Mean executive theta wPLI decreased from 0.66 pre-condition to 0.56 post-condition. This represented a mean reduction of 0.10, or approximately 14.59%. This effect was statistically significant, $t(14) = -3.98$, $p = .001$, Cohen's $dz = -1.03$, and remained significant after FDR correction, $q = .033$.

These findings indicate a reliable post-condition reduction in theta-band phase-lagged functional connectivity within the executive-control network.

Table 1

Significant Matched Pre/Post Executive Network Findings

Measure	Pre Mean	Post Mean	Mean Difference	Percent Change	t	p	Cohen's dz	FDR q
Executive theta wPLI strength	3.96	3.39	-0.58	-14.59%	-3.98	.001	-1.03	.033
Executive theta wPLI global efficiency	0.71	0.62	-0.09	-12.82%	-4.26	< .001	-1.10	.033
Executive theta mean wPLI	0.66	0.56	-0.10	-14.59%	-3.98	.001	-1.03	.033

Executive Network Clustering

Executive theta wPLI clustering also decreased from 0.61 pre-condition to 0.51 post-condition, representing a mean reduction of 0.10, or approximately 15.77%. This finding was statistically significant before correction, $t(14) = -3.09$, $p = .008$, Cohen's $d_z = -0.80$, but did not survive FDR correction, $q = .145$.

Because this result did not remain significant after correction, it should be interpreted as supportive but exploratory.

Default Mode Network Proxy Findings

Default mode network proxy findings were exploratory. The strongest DMN-related trend was an increase in alpha-band coherence clustering. DMN proxy alpha coherence clustering increased from 0.20 pre-condition to 0.30 post-condition. This represented a mean increase of 0.10, or approximately 49.24%.

This finding was statistically significant before correction, $t(14) = 2.17$, $p = .048$, Cohen's dz = 0.56, but did not survive FDR correction, $q = .464$.

Although not statistically robust after correction, the direction of this finding suggests a possible increase in local alpha-band clustering within DMN proxy regions following the intervention. Because this was an exploratory scalp-level proxy measure, it should be interpreted cautiously and replicated using source-localized EEG methods.

Table 2

Exploratory Network-Level Trends

Measure	Pre Mean	Post Mean	Mean Difference	Percent Change	t	p	Cohen's dz	FDR q
Executive theta wPLI clustering	0.61	0.51	-0.10	-15.77%	-3.09	.008	-0.80	.145
DMN proxy alpha coherence clustering	0.20	0.30	0.10	49.24%	2.17	.048	0.56	.464
DMN proxy theta mean wPLI	0.63	0.54	-0.10	-15.04%	-2.13	.051	-0.55	.464
DMN proxy theta wPLI strength	3.17	2.69	-0.48	-15.04%	-2.13	.051	-0.55	.464
DMN proxy theta wPLI global efficiency	0.69	0.60	-0.09	-12.93%	-2.12	.052	-0.55	.464

Salience Network Proxy Findings

Exploratory salience network proxy analyses showed a trend toward reduced theta-band wPLI connectivity, although these effects did not reach statistical significance.

Salience proxy theta wPLI strength decreased from 3.20 to 2.96, representing a reduction of approximately 7.56%, $t(14) = -1.52$, $p = .151$, Cohen's dz = -0.39, $q = .464$.

Salience proxy theta wPLI clustering decreased from 0.58 to 0.52, representing a reduction of approximately 10.22%, $t(14) = -1.62$, $p = .127$, Cohen's dz = -0.42, $q = .464$.

These findings should be considered nonsignificant exploratory trends.

Aperiodic Activity and 1/f Findings

Aperiodic spectral analyses examined slope and offset across cortical regions. No aperiodic measure survived FDR correction. However, the strongest trend was a reduction in occipital aperiodic offset.

Occipital aperiodic offset decreased from 2.16 pre-condition to 1.86 post-condition, representing a mean reduction of 0.30, or approximately 14.00%. This finding was statistically significant before correction, t(14) = -2.36, p = .033, Cohen's dz = -0.61, but did not survive FDR correction, q = .963.

Additional offset trends were observed in parietal and temporal regions. Parietal offset decreased from 2.07 to 1.85, representing a 10.59% reduction, t(14) = -1.71, p = .109, Cohen's dz = -0.44, q = .963. Temporal offset decreased from 1.97 to 1.63, representing a 17.16% reduction, t(14) = -1.67, p = .117, Cohen's dz = -0.43, q = .963.

No significant aperiodic slope effects were identified. Executive aperiodic slope showed minimal change, decreasing from -1.49 to -1.50, t(14) = -0.06, p = .951, Cohen's dz = -0.02, q = .963.

Table 3

Exploratory Aperiodic Offset Findings

Region	Pre Mean	Post Mean	Mean Difference	Percent Change	t	p	Cohen's dz	FDR q
Occipital offset	2.16	1.86	-0.30	-14.00%	-2.36	.033	-0.61	.963
Parietal offset	2.07	1.85	-0.22	-10.59%	-1.71	.109	-0.44	.963
Temporal offset	1.97	1.63	-0.34	-17.16%	-1.67	.117	-0.43	.963

Spectral Power Findings

Regional spectral power analyses did not identify any findings that survived FDR correction. However, several posterior absolute power trends suggested lower post-condition power, particularly in parietal regions.

Parietal delta absolute power decreased from 123.77 to 29.55, representing a 76.12% reduction, t(14) = -1.66, p = .119, Cohen's dz = -0.43, q = .963.

Parietal alpha absolute power decreased from 119.27 to 48.30, representing a 59.51% reduction, t(14) = -1.46, p = .167, Cohen's dz = -0.38, q = .963.

Parietal theta absolute power decreased from 87.14 to 18.61, representing a 78.64% reduction, t(14) = -1.39, p = .186, Cohen's dz = -0.36, q = .963.

Parietal beta absolute power decreased from 328.03 to 43.83, representing an 86.64% reduction, t(14) = -1.31, p = .212, Cohen's dz = -0.34, q = .963.

Parietal gamma absolute power decreased from 275.78 to 29.44, representing an 89.32% reduction, t(14) = -1.29, p = .218, Cohen's dz = -0.33, q = .963.

Although these findings were directionally consistent, they were not statistically reliable after correction and should be interpreted as exploratory.

Table 4

Exploratory Posterior Power Trends

Measure	Pre Mean	Post Mean	Percent Change	t	p	Cohen's dz	FDR q
Parietal delta absolute power	123.77	29.55	-76.12%	-1.66	.119	-0.43	.963
Parietal alpha absolute power	119.27	48.30	-59.51%	-1.46	.167	-0.38	.963
Parietal theta absolute power	87.14	18.61	-78.64%	-1.39	.186	-0.36	.963
Parietal beta absolute power	328.03	43.83	-86.64%	-1.31	.212	-0.34	.963
Parietal gamma absolute power	275.78	29.44	-89.32%	-1.29	.218	-0.33	.963

Independent Group Findings

Independent group comparisons using all 20 pre-condition and 20 post-condition recordings were generally consistent with the matched analyses but produced weaker statistical evidence. The strongest independent-group DMN trend was an increase in DMN proxy alpha coherence clustering, which increased from 0.18 to 0.28, $t = 2.34$, $p = .026$, Hedges' $g = 0.72$. This finding did not survive FDR correction, $q = .245$.

No independent-group network findings survived FDR correction. Therefore, the matched repeated-measures findings should be considered the primary results.

Summary of Results

The most defensible finding from the present analysis was a significant reduction in executive-network theta wPLI connectivity following participation in HBL and associated technologies. This effect was observed across executive theta wPLI strength, global efficiency, and mean connectivity and survived FDR correction.

Exploratory findings suggested possible changes in executive theta clustering, DMN alpha clustering, aperiodic offset, and posterior absolute power. However, these secondary effects did not survive correction for multiple comparisons and should be interpreted cautiously.

Overall, the results support the conclusion that IOTA based programs may be associated with measurable changes in executive-network organization during resting-state EEG, while additional findings involving the DMN, aperiodic activity, and posterior power remain preliminary.

Discussion

The present investigation examined whether participation in IOTA based programs was associated with measurable changes in resting-state brain organization. Although several neurophysiological trends were observed, the most robust finding was a statistically significant reduction in theta-band weighted Phase Lag Index (wPLI) connectivity within the executive-control network among participants who completed both pre- and post-intervention assessments.

Because wPLI reduces the influence of volume conduction and zero-phase synchronization, it provides a conservative estimate of functional communication among distributed cortical regions (Vinck et al., 2011). Consequently, the observed reduction in executive theta connectivity likely represents a meaningful alteration in large-scale cortical communication rather than an artifact of scalp recording.

Executive Network Organization

The executive-control network plays a central role in attentional regulation, cognitive flexibility, working memory, behavioral monitoring, and adaptive decision making (Menon, 2011). Frontal-midline theta oscillations, in particular, have consistently been associated with executive control, conflict monitoring, and the recruitment of cognitive resources during demanding tasks (Cavanagh & Frank, 2014).

In the present study, participants demonstrated significantly lower executive-network theta connectivity during resting-state conditions following the intervention. Importantly, these recordings were obtained during quiet eyes-closed rest rather than during active cognitive performance. Consequently, reduced resting-state executive synchronization should not be interpreted as diminished executive function. Instead, one possible interpretation is that the executive-control system required less coordinated communication to maintain intrinsic resting-state organization.

This interpretation is consistent with the Neural Efficiency Hypothesis, which proposes that more efficient neural systems may require less metabolic and electrophysiological activity to maintain effective function (Neubauer & Fink, 2009). Although the present investigation did not include behavioral measures of executive performance, the observed reduction in resting executive synchronization is compatible with a more efficient resting neural organization.

Default Mode Network

Exploratory analyses also suggested modest changes in alpha-band connectivity within scalp-level proxy measures representing the Default Mode Network (DMN). While these findings did not survive correction for multiple comparisons, they demonstrated a consistent direction of change across participants.

The DMN has been associated with internally directed cognition, autobiographical memory, self-referential processing, and spontaneous thought (Buckner et al., 2008). Contemporary neuroscience no longer views the DMN simply as a "task-negative" network. Rather, healthy functioning depends upon flexible communication between the DMN, Executive Control Network, and Salience Network (Menon, 2011).

Studies of meditation and other contemplative practices have demonstrated altered interactions among these networks, often accompanied by improvements in attentional regulation and reductions in habitual self-referential thinking (Brewer et al., 2011; Lutz et al., 2008). Although the present findings are preliminary, they are broadly consistent with this emerging literature and suggest that HBL and its associated technologies may influence intrinsic network organization in ways that warrant further investigation.

Spectral Power and Aperiodic Activity

Participants also demonstrated trends toward lower posterior broadband spectral power and reduced occipital aperiodic offset following the intervention. Although these findings did not remain statistically significant after false discovery rate correction, they were sufficiently consistent to merit discussion.

Traditional EEG investigations often focus on oscillatory activity within conventional frequency bands. However, recent work has demonstrated that much of the resting EEG spectrum reflects a broadband aperiodic component rather than discrete oscillatory rhythms (Donoghue et al., 2020). Changes in this background activity may represent alterations in overall cortical activation rather than changes within specific frequency bands.

Accordingly, the present findings may suggest a quieter resting cortical state characterized by reduced spontaneous neural activity while preserving large-scale network organization. Because these observations remain exploratory, additional studies incorporating larger samples and more sophisticated aperiodic analyses are needed before firm conclusions can be drawn.

Relationship to Previous Research

The present findings extend previous work investigating neurophysiological correlates of transformative psychological experiences.

In an earlier investigation using standardized weighted low-resolution electromagnetic tomography (swLORETA), Ooms (2024) reported significant reductions in executive-network lagged coherence associated with profound mystical experiences during an IOTA based program. Although the present investigation examined longitudinal resting-state changes following an

IOTA based intervention rather than acute altered states of consciousness, both studies implicate executive-network reorganization as a potentially important neurophysiological correlate of transformative psychological processes.

The convergence of findings across two distinct IOTA based program interventions is noteworthy. While these two programs differ in their methods, both appear to influence neural systems involved in executive regulation and large-scale brain organization. Future studies directly comparing these interventions may provide valuable insight into common neurophysiological mechanisms underlying positive psychological transformation.

Clinical and Experiential Implications

The present study did not include standardized measures of subjective experience; therefore, direct relationships between EEG findings and participant experiences cannot be established. Nevertheless, the observed neurophysiological changes are consistent with experiences commonly reported by individuals participating in IOTA based programs.

Participants frequently describe improvements in mental clarity, reduced mental effort, increased emotional resilience, enhanced present-moment awareness, decreased psychological reactivity, and an increased sense of calm and well-being. These reports are also consistent with observations from contemplative neuroscience, where alterations in communication among executive-control, default mode, and salience networks have been associated with improvements in attentional regulation, emotional flexibility, and reduced self-referential processing (Brewer et al., 2011; Lutz et al., 2008).

From a clinical perspective, reduced resting-state executive synchronization may correspond to a decreased need for sustained top-down cognitive regulation, potentially allowing greater cognitive flexibility and emotional adaptability. Likewise, trends toward reduced broadband cortical activity may be compatible with participants' descriptions of a quieter internal dialogue and decreased mental overactivity.

These interpretations remain theoretical because subjective experiences were not systematically measured in the present investigation. Future studies should incorporate validated measures of anxiety, depression, psychological flexibility, flourishing, mindfulness, emotional regulation, resilience, and subjective well-being to better understand how neurophysiological changes relate to lived experience.

Limitations

Several limitations should be considered when interpreting these findings.

First, the study included a relatively modest sample size, reducing statistical power to detect small neurophysiological effects. Replication with larger samples will be important to determine the stability of these findings.

Second, recordings were acquired using multiple EEG acquisition systems (CGX, Deymed TruScan, and NeuroField Q21). Although preprocessing procedures were standardized and all recordings underwent artifact cleaning using NeuroGuide, subtle hardware differences may have contributed to measurement variability.

Third, analyses of the Default Mode Network were based on scalp-level proxy measures rather than source-localized cortical networks. Future investigations incorporating source localization methods such as swLORETA may improve anatomical specificity.

Finally, participants received an integrated intervention consisting of Higher Brain Living® and associated supportive technologies. Consequently, the present findings should be interpreted as reflecting the multimodal intervention as a whole rather than the isolated effects of any individual therapeutic component.

Conclusions

This investigation provides preliminary evidence that participation in IOTA based program may be associated with measurable changes in resting-state brain organization.

The strongest finding was a reduction in executive-network theta-band functional connectivity, suggesting altered communication among cortical systems involved in executive regulation. Exploratory findings involving default mode network organization, posterior cortical activity, and aperiodic EEG measures provide additional directions for future research but require replication in larger samples.

Overall, the present results support continued investigation IOTA based programs as a multimodal intervention capable of influencing large-scale neural organization. Future studies integrating resting-state EEG, source-localized analyses, behavioral outcomes, and validated psychological measures will help clarify the neurophysiological mechanisms through which IOTA based programs may contribute to psychological well-being and adaptive functioning.

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