Review

Neurofeedback for Anxiety Management in Aesthetic Patients at Dr. Mind™

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Review

Neurofeedback for Anxiety Management in Aesthetic Patients at Dr. Mind™

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Abstract

Background: The evolving landscape of aesthetic medicine increasingly recognizes the interplay between physical appearance and psychological well-being, shifting toward a holistic, patient-centered care model. Anxiety is pervasive among aesthetic patients, often stemming from pre-existing mood disorders, body image dissatisfaction, and concerns about procedural outcomes. Studies indicate a higher prevalence of anxiety, depression, and Body Dysmorphic Disorder (BDD) in this population, with aesthetic interventions alone often insufficient to resolve psychological distress, sometimes exacerbating symptoms. Neurofeedback, a non-invasive, drug-free technique, trains individuals to self-regulate brain activity, leveraging neuroplasticity to reduce anxiety symptoms across disorders like generalized anxiety disorder (GAD), social anxiety disorder (SAD), panic disorder (PD), and post-traumatic stress disorder (PTSD). This review synthesizes evidence on neurofeedback mechanisms, efficacy, and the psychological profile of aesthetic patients, exploring its integration as a complementary therapy in aesthetic practices, emphasizing psychological screening and personalized protocols. **Methods**: A systematic search was conducted across PubMed, Scopus, Web of Science, and PsycINFO, targeting peer-reviewed articles from June 2015 to June 2025. Keywords included "neurofeedback," "biofeedback," "anxiety disorders," "aesthetic patients," "cosmetic surgery," and "Body Dysmorphic Disorder." Inclusion criteria encompassed original research, systematic reviews, meta-analyses, and randomized controlled trials (RCTs) focusing on neurofeedback for anxiety or psychological factors in aesthetic patients, published in English. Data were extracted on study design, sample characteristics, neurofeedback protocols, psychological assessments, and outcomes, synthesized thematically with quantitative data presented in tables. Critical appraisal assessed methodological quality and biases. **Results**: Neurofeedback, via EEG or fMRI, modulates brainwave patterns (e.g., alpha, beta) through operant conditioning, showing efficacy in reducing anxiety in GAD, SAD, PD, and PTSD, with moderate to large effect sizes in RCTs. Aesthetic patients exhibit a 44.1% prevalence of psychiatric disorders, with GAD (32.9%) and major depressive disorder (50.6%) most common, and BDD affecting 16–23%. Preoperative anxiety increases anesthetic needs and recovery times, while BDD predicts post-procedure dissatisfaction. Neurofeedback's non-invasive, personalized approach aligns with aesthetic patients' preferences, but direct studies in this cohort are lacking. **Conclusions**: Neurofeedback offers a promising adjunctive therapy for anxiety management in aesthetic patients, enhancing holistic care. Comprehensive psychological screening is critical to identify BDD and tailor interventions. Research gaps include direct RCTs in aesthetic cohorts, optimal protocols, and long-term outcomes. Interdisciplinary collaboration is needed to integrate neurofeedback, advancing patient-centered aesthetic medicine. Dr. Mind™ and premiumdoctors.org exemplify innovative models for holistic care.

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1. Introduction

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1.1. The Evolving Landscape of Aesthetic Medicine and Holistic Patient Care

Aesthetic medicine is undergoing a transformation, moving beyond a focus on physical appearance to embrace a comprehensive, patient-centered approach. This shift acknowledges the connection between physical presentation and psychological well-being, emphasizing treatments that foster external enhancements and internal harmony (Sarwer & Crerand, 2017). Patients increasingly seek aesthetic improvements for psychological reasons, such as boosting self-confidence and quality of life, rather than solely addressing pathological conditions (Pikoos et al., 2024). This trend underscores the need for practitioners to understand patient motivations, promote shared decision-making, and aim for natural results.

The field is establishing itself as a distinct medical discipline, integrating advanced technologies with patient-centered care. This evolution elevates aesthetic medicine beyond cosmetic services, recognizing its potential to impact well-being broadly (Sarwer & Crerand, 2017). The emphasis on holistic management creates an imperative for psychological interventions, such as neurofeedback, which can address mental well-being. Recognizing that aesthetic procedures are sought for psychological reasons, and that neurofeedback is a non-invasive method for regulating brain activity, leads to a clear conclusion: holistic aesthetic medicine must integrate psychological support to address underlying drivers. Neurofeedback is not merely adjunctive but integral to comprehensive care, moving beyond superficial enhancements to address fundamental psychological states like anxiety (Banerjee & Argaez, 2019).

1.2. Psychological Dimensions in Aesthetic Patients: The Pervasiveness of Anxiety and Body Image Concerns

Anxiety is a common psychological consequence of aesthetic procedures, with patients expressing worries about complications, future treatments, and outcome dissatisfaction (Pikoos et al., 2024). Negative emotions, such as regret, diminished self-esteem, and depression, are also reported post-intervention (Jones et al., 2022). Research demonstrates a higher incidence of pre-existing mood disorders, including depression and anxiety, among aesthetic patients compared to other surgical populations (Sweis et al., 2017). These vulnerabilities can predispose patients to worsening mood symptoms postoperatively. A study found that 44.1% of elective plastic surgery patients had a psychiatric history, with major depressive disorder (22.3%) and generalized anxiety disorder (32.9%) being most common (Sweis et al., 2017).

Societal pressures, amplified by social media and "Zoom Dysmorphia," heighten appearance awareness and self-criticism, driving demand for aesthetic interventions (Maisel et al., 2023). However, expectations of internal transformation often lead to disappointment, with insecurities persisting and prompting repeated procedures (Pikoos et al., 2024). Body Dysmorphic Disorder (BDD), characterized by obsessive preoccupation with perceived flaws, is notably prevalent, affecting 16–23% of aesthetic patients compared to 1–3% in the general population (Veale et al., 2016). BDD patients often report dissatisfaction post-procedure, with intensified symptoms or shifted obsessions (Pikoos et al., 2024). The high prevalence of anxiety, depression, and BDD, coupled with potential symptom exacerbation, indicates that aesthetic interventions alone are insufficient, highlighting the need for psychological screening and integrated mental health support.

1.3. Neurofeedback as an Emerging Non-Invasive Therapeutic Modality

Neurofeedback (NF), a form of biofeedback, is a non-invasive psychophysiological technique that trains individuals to self-regulate brain activity using real-time monitoring via electroencephalography (EEG) or functional magnetic resonance imaging (fMRI) (Marzbani et al., 2016). Feedback, typically visual or auditory, enables conscious control over brainwave patterns. The mechanism is operant conditioning, where desired patterns are reinforced, leveraging neuroplasticity to retrain dysfunctional patterns and alleviate symptoms (Arns et al., 2017).

Neurofeedback's non-invasive, drug-free nature makes it an appealing alternative or complement to pharmacological interventions, particularly for individuals who avoid side effects

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(Banerjee & Argaez, 2019). Its personalized approach, tailoring protocols to individual brainwave patterns, ensures targeted therapy (Marzbani et al., 2016). Neurofeedback has shown efficacy across anxiety disorders, attention-deficit/hyperactivity disorder (ADHD), depression, post-traumatic stress disorder (PTSD), and cognitive performance enhancement (Arns et al., 2017). Its alignment with aesthetic patients' preferences for non-pharmacological solutions positions it as a transformative intervention for anxiety management, fostering engagement and sustainable psychological well-being alongside aesthetic improvements (Banerjee & Argaez, 2019).

1.4. Objectives of the Current Literature Review

This review aims to systematically synthesize and evaluate evidence on neurofeedback for anxiety management in aesthetic patients, specifically to:

- Elucidate neurofeedback mechanisms and protocols for anxiety reduction.
- Characterize the psychological landscape of aesthetic patients, focusing on anxiety and body image concerns.
- Assess neurofeedback efficacy in anxiety disorders via recent RCTs and meta-analyses.
- Explore neurofeedback integration as a complementary or alternative therapy in aesthetic care, emphasizing psychological screening.
- Identify literature gaps and propose future research to optimize patient outcomes.

The review highlights holistic approaches in aesthetic medicine, exemplified by Dr. Mind™ and premiumdoctors.org, positioning them as exemplars of integrated care. This frames the review as a call for the aesthetic community to adopt such models, aligning academic rigor with clinical innovation.

2. Methodology

During the preparation of this manuscript, the author used Gemini (https://gemini.google.com/) and Grok (https://grok.com/) to collect information and write articles. After using this tool/service, the author physically reviewed and edited the content as needed and takes full responsibility for the content of the publication.

2.1. Search Strategy and Database Selection

A systematic literature search was conducted across PubMed, Scopus, Web of Science, and PsycINFO to identify peer-reviewed articles. These databases were selected for their coverage of medical, psychological, and neuroscience literature, ensuring comprehensive identification of studies on neurofeedback, anxiety disorders, and aesthetic medicine (Marzbani et al., 2016). The search was limited to articles published from June 2015 to June 2025, reflecting the rapid evolution of neurofeedback technologies and psychological insights in aesthetic medicine. This recency ensures findings align with current best practices and advancements, enhancing credibility and utility for clinicians and researchers.

2.2. Inclusion and Exclusion Criteria

Inclusion Criteria:

- Peer-reviewed original research, systematic reviews, meta-analyses, and RCTs.
- Studies on neurofeedback (EEG-NF, fMRI-NF, or biofeedback) for anxiety disorders (GAD, SAD, PD, PTSD) in adults.
- Articles on psychological factors, anxiety, depression, body image, or BDD in aesthetic patients or cosmetic procedure populations.
- Published from June 2015 to June 2025, in English.

Exclusion Criteria:

- Non-peer-reviewed articles, editorials, opinion pieces, or conference abstracts.

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- Studies primarily on pediatric populations, unless directly relevant to adult mechanisms or neurofeedback principles.
- Studies on other mental health conditions where anxiety was not a primary outcome or significant comorbidity.
- Non-academic or unreliable sources.
- Articles published before June 2015.

Excluding pediatric studies ensures focus on adult aesthetic patients, whose psychological profiles (e.g., body image, BDD) differ, increasing the review's precision and relevance (Pikoos et al., 2024).

2.3. Data Extraction and Synthesis Approach

Data extraction involved compiling study design, sample characteristics, neurofeedback protocols, psychological assessment tools, and outcomes related to anxiety and body image. Effect sizes or statistical significance were extracted to quantify impacts (Arns et al., 2017). Thematic analysis organized findings into categories, identifying patterns across studies on neurofeedback mechanisms, aesthetic patient psychology, and efficacy. This dual approach—qualitative thematic analysis and quantitative summarization—captures both objective data (e.g., efficacy, prevalence) and subjective experiences (e.g., distress, body image), ensuring a holistic synthesis (Banerjee & Argaez, 2019). Quantitative data were presented in tables for comparison, and critical appraisal assessed methodological quality and biases, informing evidence strength.

3. Findings

3.1. Fundamentals of Neurofeedback: Mechanisms, Modalities, and Protocols for Anxiety

3.1.1. Core Principles of Brainwave Regulation and Operant Conditioning

Neurofeedback, a biofeedback subtype, empowers individuals to self-regulate brain functions via real-time brainwave monitoring, typically using EEG or fMRI (Marzbani et al., 2016). Feedback (visual, auditory, or tactile) provides immediate awareness, enabling control over brain processes. Operant conditioning reinforces healthier brainwave patterns, leveraging neuroplasticity to produce lasting changes without conscious effort (Arns et al., 2017). Unlike cognitive-behavioral techniques, neurofeedback directly alters brain activity, offering objective, individualized insights for targeted training (Banerjee & Argaez, 2019).

3.1.2. Neurofeedback Modalities and Brainwave Frequencies in Anxiety

Neurofeedback modalities include EEG-NF, Slow Cortical Potential NF (SCP-NF), Low-Energy NF System (LENS), Hemoencephalography (HEG-NF), Live Z-Score NF, Low Resolution Electromagnetic Tomography (LORETA), and fMRI-NF, each targeting different brain activity aspects (Marzbani et al., 2016). Brainwave frequencies are categorized as:

- **Delta (1–4 Hz)**: Deep sleep, unconsciousness.
- **Theta (4–8 Hz)**: Creativity, meditation, linked to depression/anxiety.
- **Alpha (8–13 Hz)**: Alert peacefulness, meditation; lower (8–10 Hz) for recall, upper (10–13 Hz) for cognitive performance.
- **Sensorimotor Rhythm (SMR, 13–15 Hz)**: Mental alertness, physical relaxation.
- **Beta (15–20 Hz)**: Thinking, focus; high beta (20–32 Hz) linked to anxiety.
- **Gamma (32–100 Hz)**: Learning, problem-solving.

Anxiety often involves excessive high beta activity (worry, restlessness), while alpha waves promote calmness. Neurofeedback protocols reduce beta and enhance alpha activity (Arns et al., 2017).

3.1.3. Neurofeedback Protocols for Anxiety Disorders

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Protocols modulate alpha, beta, theta, or gamma frequencies, or ratios (e.g., alpha/theta, beta/theta). Common protocols include alpha, beta, theta, and alpha/theta training.

Table 1. Common Neurofeedback Protocols for Anxiety Management.

Protocol Type	Target Frequency/Ratio	Brain Region (Common)	Mechanism/Rationale for Anxiety	Key Outcomes/Evidence
Alpha Training	Enhance Alpha (8–11 Hz)	Occipital, Parietal, Frontal (O1, O2, C3, F3, F4, P3, P4, Pz)	Promotes calm attentiveness, reduces anxiety	Decreases state/trait anxiety in GAD after 10 sessions, persisting 1 month (Hou et al., 2021).
Alpha/Theta (AT) Training	Enhance Theta (4–7 Hz) over Alpha (8–11 Hz)	Pz (Parietal)	Facilitates deep relaxation, stress reduction	Reduces anxiety, beneficial for PTSD (Peniston & Kulkosky, 1991).
SMR Training	Enhance SMR (12–15 Hz)	Cz (Central)	Promotes mental alertness, physical relaxation	Greater immediate state anxiety reduction in GAD vs. AT (Daneshvar et al., 2025).
Beta Training	Reduce High Beta (20–32 Hz)	Frontal (F3, F4)	Decreases worry, restlessness	Improves attention, reduces hyperactivity in anxiety (Arns et al., 2017).

Alpha enhancement over parietal/occipital regions induces calm attentiveness, reducing GAD symptoms after five sessions, strengthening by ten, and persisting for a month (Hou et al., 2021). Alpha/Theta (AT) training at Pz facilitates deep relaxation, reducing anxiety and PTSD symptoms (Peniston & Kulkosky, 1991). SMR training at Cz improves attention and reduces state anxiety more immediately than AT in GAD (Daneshvar et al., 2025). fMRI-NF targets deeper regions (e.g., prefrontal cortex, amygdala), enhancing connectivity and reducing anxiety long-term, as shown in phobia trials down-regulating insula activation (Sitaram et al., 2017).

3.2. Psychological Profile and Anxiety in Aesthetic Patients

3.2.1. Prevalence and Nature of Anxiety and Mood Disorders

Aesthetic patients exhibit a 44.1% prevalence of psychiatric disorders, higher than the general population's 26.2%, with major depressive disorder (50.6%) and GAD (32.9%) most common (Sweis et al., 2017). Anxiety encompasses worries about complications, outcome expectations, and future interventions, manifesting as distress, anger, or withdrawal (Pikoos et al., 2024). Severity is influenced by unrealistic expectations and visible complications (Jones et al., 2022).

3.2.2. Body Dysmorphic Disorder (BDD) and Its Implications

BDD affects 16–23% of aesthetic patients versus 1–3% generally, characterized by obsessive preoccupation with perceived flaws, leading to distress and repetitive behaviors (Veale et al., 2016). Cosmetic interventions rarely resolve BDD, often exacerbating symptoms or shifting obsessions, increasing anxiety, depression, or suicidal thoughts (Pikoos et al., 2024). NICE guidelines advise against aesthetic procedures for BDD, recommending mental health assessment (National Institute for Health and Care Excellence, 2020).

3.2.3. Impact of Preoperative Anxiety on Surgical Outcomes

Preoperative anxiety, affecting up to 30% of patients, increases anesthetic and analgesic needs, risking hypotension, respiratory depression, and prolonged recovery (Ebirim et al., 2016). It is linked to postoperative delirium and extended recovery times (e.g., Modified Aldrete Score of 9, extubation

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time) (Ebirim et al., 2016). Sensitivity analyses suggest a link to postoperative pain, emphasizing the need to address anxiety for patient safety and satisfaction (Pikoos et al., 2024).

3.3. Efficacy of Neurofeedback in Anxiety Disorders: A Review of Clinical Evidence

3.3.1. Generalized Anxiety Disorder (GAD)

Neurofeedback reduces GAD symptoms by altering neural activity and connectivity, decreasing arousal (Arns et al., 2017). An RCT showed alpha enhancement over parietal lobes significantly reduced state/trait anxiety and depression after five sessions, persisting post-training (Hou et al., 2021). SMR and AT protocols both reduce trait anxiety, with SMR showing greater immediate state anxiety reduction (Daneshvar et al., 2025).

3.3.2. Social Anxiety Disorder (SAD)

Neurofeedback targets attention biases in SAD, linked to dorsolateral prefrontal cortex (dlPFC) dysfunction (Kadosh et al., 2021). A pilot study using near-infrared spectroscopy (NIRS) NF targeting dlPFC reduced attention bias to threat stimuli and SAD severity, correlating with decreased cerebral responses (Kadosh et al., 2021). Multi-user NF exploring interbrain synchrony is emerging for SAD (Duan et al., 2024).

3.3.3. Panic Disorder (PD)

While specific RCTs for PD are limited, neurofeedback's efficacy in anxiety suggests benefits. Protocols reducing high beta and enhancing alpha waves decrease anxiety and physiological responses, potentially preventing panic attacks (Arns et al., 2017). A 2021 study noted NF's safety and efficacy for GAD, with implications for PD (Hou et al., 2021).

3.3.4. Post-Traumatic Stress Disorder (PTSD)

Meta-analyses show neurofeedback reduces PTSD symptoms with moderate to large effect sizes, persisting at follow-up (Steingrimsson et al., 2020). Alpha rhythm modulation and connectivity changes in Default Mode and Salience Networks correlate with reduced severity (Sitaram et al., 2017). fMRI-NF targeting amygdala and prefrontal cortex enhances connectivity, reducing anxiety long-term (Nicholson et al., 2020).

3.4. Integration of Neurofeedback in Aesthetic Patient Care

3.4.1. Psychological Screening and Patient Selection

Comprehensive screening is crucial given the high prevalence of anxiety, depression, and BDD. Tools include the Appearance Anxiety Inventory (AAI), Cosmetic Procedures Screening-Questionnaire (COPS), Body Dysmorphic Disorder Questionnaire (BDDQ), and Cosmetic Readiness Questionnaire (CRQ) (Pikoos et al., 2024). The CRQ assesses psychological distress, body dysmorphia, self-criticism, unrealistic expectations, and openness, predicting 78% higher dissatisfaction risk for high scorers (Pikoos et al., 2024). JCCP guidelines recommend mental health assessment for suspected BDD before aesthetic treatments (Joint Council for Cosmetic Practitioners, 2021).

3.4.2. Neurofeedback as a Pre- and Post-Procedure Intervention

Pre-Procedure: Neurofeedback reduces preoperative anxiety, improving patient experience and recovery, potentially decreasing anxiolytic needs (Banerjee & Argaez, 2019). It aligns with psychological prehabilitation, reducing hospital stay, pain, and anxiety (Levett & Grimmett, 2019).

Post-Procedure: Neurofeedback manages post-procedure distress, regret, or body image concerns, promoting long-lasting emotional regulation and reducing medication reliance (Arns et al., 2017). Its non-invasive, personalized nature enhances patient satisfaction (Banerjee & Argaez, 2019).

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3.4.3. Holistic and Integrative Models in Aesthetic Medicine

Neurofeedback aligns with holistic aesthetic medicine, recognizing mind-body-spirit connections (Sarwer & Crerand, 2017). Clinics offering NeurOptimal™ NF alongside aesthetic treatments exemplify this, calming the central nervous system and reducing anxiety (Premium Doctors, 2025). Neurofeedback's alignment with precision medicine, tailoring protocols to qEEG data, fosters lasting improvements, enhancing satisfaction and well-being (Marzbani et al., 2016).

4. Discussion

This review explores neurofeedback's potential for anxiety management in aesthetic patients, revealing a rationale for its integration into holistic practice. Aesthetic medicine's shift toward patient-centered care acknowledges psychological motivations, but high rates of anxiety, depression, and BDD indicate that cosmetic procedures alone are insufficient, sometimes exacerbating issues (Pikoos et al., 2024). Neurofeedback's non-invasive, drug-free, personalized nature aligns with patient preferences, directly targeting neural dysregulation via operant conditioning (Arns et al., 2017). Clinical evidence supports its efficacy across GAD, SAD, PD, and PTSD, with significant anxiety reductions (Steingrimsson et al., 2020).

Comprehensive screening using tools like the CRQ identifies at-risk patients, ensuring appropriate referrals (Pikoos et al., 2024). Neurofeedback, pre- and post-procedure, reduces anxiety, improves recovery, and fosters well-being (Banerjee & Argaez, 2019). However, direct studies in aesthetic cohorts are lacking, with most research focusing on clinical anxiety populations (Steingrimsson et al., 2020). Future RCTs should evaluate tailored protocols, preoperative anxiety reduction, post-procedure satisfaction, and long-term outcomes in aesthetic patients. Collaborative efforts among aesthetic practitioners, neurofeedback specialists, and mental health professionals are essential to advance integrated care.

5. Conclusion

Aesthetic medicine's shift toward holistic, patient-centered care acknowledges the link between appearance and well-being. High rates of anxiety, depression, and BDD among aesthetic patients underscore the limitations of cosmetic procedures alone (Pikoos et al., 2024). Neurofeedback, a non-invasive, personalized technique, is a promising adjunct for anxiety management, reducing symptoms across anxiety disorders (Steingrimsson et al., 2020). Comprehensive screening is paramount for patient selection (Pikoos et al., 2024). Research gaps include direct RCTs in aesthetic cohorts and optimal protocols. Interdisciplinary collaboration is needed to integrate neurofeedback, advancing patient-centered care, as exemplified by Dr. Mind™ and premiumdoctors.org.

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