ORIGINAL ARTICLE

Wired for Relief: Assessing the Risks and Rewards of DBS in Treatment-Resistant Obsessive Compulsive Disorder

J of Neurophysiological Monitoring 2025; 3(2): 88-100 ISSN 2995-4886

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KEYWORDS: OCD, DBS, EEG, TMS, treatment.

CITE AS: Nataraja V, Ravindran J, Steelman A, Turner J, Jahangiri FR. Wired for Relief: Assessing the Risks and Rewards of DBS in Treatment-Resistant OCD. J of Neurophysiological Monitoring 2025; 3(2): 88-100. doi:10.5281/zenodo.16222883.

ARTICLE HISTORY:
Received: Jun 16, 2025
Accepted: Jul 14, 2025
Available online: Jul 20, 2025

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ABSTRACT

Obsessive-compulsive disorder (OCD) can be a lifelong and debilitating condition that can be resistant to pharmacological and psychotherapeutic treatments. Over the last couple of decades, the emergence of deep brain stimulation (DBS) has been proven as an effective form of treatment for patients with movement disorders such as Parkinson's disease, and even for patients with epilepsy. With the previous success of DBS, this neurosurgical intervention has now also become a promising form of treatment for patients suffering from treatment-resistant OCD. But with its newness, its efficacy, safety, and long-term success remain under evaluation. The goal of this review is to evaluate, assess, and discuss the sustained long-term effectiveness, ideal target locations, risks, and safety, including suicide rates, and compare DBS to more non-invasive forms of treatment such as TMS (transcranial magnetic stimulation). The results showed that, after treatment, patients experienced a significant reduction in their mean Y-BOCS score.

INTRODUCTION

Obsessive-compulsive disorder (OCD) is a chronic and debilitating psychiatric condition characterized by the presence of intrusive, distressing thoughts (obsessions) and repetitive behaviors or mental acts (compulsions) performed in response to these thoughts. As outlined in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), these symptoms are time-consuming and cause significant disruption in social, occupational, and daily functioning [1]. Affecting roughly 1–3% of the population, OCD can be profoundly disabling, particularly for those who do not respond to standard treatments like cognitive-behavioral therapy (CBT) and selective serotonin reuptake inhibitors (SSRIs). Approximately 40% to 60% of patients experience significant improvement with these therapies, and 10%

develop severe, refractory symptoms that are unresponsive to multimodality treatment [2]. As humans, a wide range of thoughts enter our stream of consciousness. When our cortisol levels rise and we begin to stress over certain events, it's natural for us to think about the same thing repeatedly. However, once these stressful thoughts begin to control our behaviors, obsession creeps in, and OCD becomes the diagnosis. Behavioral therapies were at the forefront of treatment, introduced as options for potential recovery. These techniques were ultimately ineffective, resulting in heightened patient anxiety and discomfort. Patients were deliberately exposed to anxiety-provoking stimuli while being instructed to refrain from engaging in their usual compulsive behaviors, which exacerbated distress rather than alleviating symptoms [2]. Due to the overall negative stigmas associated with OCD, the history of treatment options for individuals dealing with this disorder was limited and unethical at times. In addition to the use of exposure techniques, physicians have developed pharmacological treatment plans for patients since the early 1900s, specifically those involving selective serotonin reuptake inhibitors (SSRIs). While these have promising results, the risk of drug addiction and dependency is not an option that all are comfortable with, as gastrointestinal and sexual complications are prominent adverse effects [2]. For individuals who don't find relief with traditional treatments, neuromodulation has opened exciting possibilities, particularly with options like deep brain stimulation (DBS). DBS, while more invasive, involves placing electrodes in specific areas of the brain to send targeted electrical signals. One of its most significant advantages is that it can be adjusted over time and even reversed if necessary, providing doctors and patients with greater flexibility. The adaptability of deep brain stimulation (DBS) is especially beneficial for patients with severe or complex presentations, offering a customizable approach to treating a heterogeneous condition [2]. Multiple brain targets have been explored for OCD-DBS, most commonly, the striatal region, including the anterior limb of the internal capsule, ventral capsule/ventral striatum, and nucleus accumbens, which are involved in reward and decision-making circuits. Deep brain stimulation (DBS) has demonstrated encouraging outcomes for patients with treatment-refractory obsessive-compulsive disorder (OCD), especially where conventional therapies have failed. However, its status as an established treatment remains a subject of active debate. As highlighted in the literature, DBS has yet to gain widespread recognition as an established therapeutic option for treatment-resistant OCD. Reflecting persistent uncertainty within both clinical and regulatory domains [1].

In the United States, the Food and Drug Administration (FDA) has granted a Humanitarian Device Exemption (HDE) for the use of DBS in OCD, which permits clinical application under specific constraints but does not equate to full regulatory approval. Similarly, in Europe, the European Medicines Agency (EMA) recognizes DBS primarily for investigational or off-label use in OCD, contingent upon national guidelines and ethical review. These classifications underscore the need for broader validation through randomized multicenter trials, refined patient selection criteria, and longitudinal safety data to support more definitive integration into mainstream psychiatric care.

Nonetheless, they report that symptom improvements in some DBS studies reach 40–42% on the Yale-Brown Obsessive Compulsive Scale (Y-BOCS), a substantial reduction in symptom severity. Untreated OCD

can lead to significant and prolonged suffering, as well as diminished quality of life. One study reported that patients with obsessive-compulsive disorder (OCD) endured an average duration of untreated illness (DUI) of seven years, despite exhibiting substantial functional impairment [3]. This delay is often rooted in ignorant claims like that of OCD symptoms not being associated with an illness or that one can overcome the symptoms independently. As a result, a chronic and often worsening trajectory is seen in patients, with especially early-onset patients showing particularly long delays before seeking care. Although the duration of untreated illness (DUI) has not been directly linked as a definitive predictor of treatment remission, research involving OCD patients with minimal or absent prior intervention underscores the critical importance of early detection and public education in reducing the risk of long-term disability associated with untreated OCD [3]. As traditional treatments may be delayed or insufficient for many, expanding research and integration of neuromodulation techniques like DBS and TMS could offer alternative, effective interventions for treatment-resistant cases. Overall, this paper examines the effectiveness of DBS techniques in treating treatment-resistant OCD, focusing on the range of real-world outcomes, targeted brain regions, patient tolerability, and ethical implications. We propose that DBS may provide more profound and more lasting relief for those with the most severe, long-standing symptoms. It's important to understand these differences clearly so that treatment plans in psychiatric neuromodulation can be more informed and tailored to each person's needs.

LITERATURE REVIEW

Although first-line treatments such as CBT and SSRIs are effective for many patients with OCD, approximately 10% of patients develop severe, refractory symptoms unresponsive to multimodality treatment [4]. In a world where anything is possible, DBS has emerged as a promising and increasingly validated therapeutic option for this small yet significant subset of patients. Serious exploration into the use of deep brain stimulation (DBS) for psychiatric disorders began in the late 1990s, when preliminary studies targeting the anterior limb of the internal capsule revealed that neuromodulation could significantly alleviate compulsive symptoms in patients who had not responded to conventional treatments [5]. Over the last two decades, a growing body of research has supported DBS as an effective intervention for refractory OCD, shining a light on the progress of neuroscience and patient care options. Although, like anything new, critics have questions regarding optimal targets, mechanisms of action, and patient selection.

OCD remains one of the most challenging psychiatric conditions to treat, especially when traditional methods fail. Recent systematic reviews have significantly strengthened the scientific and clinical foundation supporting the use of DBS in the treatment of obsessive-compulsive disorder. As our understanding of this intervention has evolved, it has become increasingly clear that DBS holds transformative potential for advancing patient care. From a patient-centered perspective, deep brain stimulation (DBS) has been linked to marked reductions in symptom severity among individuals with

chronic, treatment-resistant obsessive-compulsive disorder (OCD), with many cases demonstrating durable improvements over extended follow-up periods [6]. These findings represent a breakthrough for patient care, offering hope and tangible relief to individuals who have struggled for years with persistent, disabling symptoms. By achieving meaningful symptom reduction, DBS enables patients to reclaim aspects of daily living that were once dominated by obsessive fears and compulsive rituals, fostering greater independence, emotional well-being, and social reintegration. In a similarly influential study, a randomized, sham-controlled trial targeting the bed nucleus of the stria terminalis (BNST) demonstrated that active stimulation yielded significantly greater clinical improvement compared to sham conditions. Moreover, most participants who responded to the intervention sustained therapeutic benefits for at least six months [7]. These results further reinforce the critical role of DBS in enhancing patient outcomes and expanding the range of effective treatments available to those with the most severe and persistent forms of OCD. Despite this promising progress, several critical knowledge gaps continue to limit the full realization of DBS's potential. For starters, there remains no clear consensus regarding the most effective neural target for stimulation. Investigations into deep brain stimulation (DBS) have targeted a range of neural structures, including the anterior limb of the internal capsule, the subthalamic nucleus, and the nucleus accumbens, each demonstrating varying levels of therapeutic efficacy. However, unlike more standardized interventions, and despite encouraging outcomes across multiple regions, direct head-to-head comparisons remain absent, limiting the ability to determine optimal stimulation targets [8]. This lack of definitive guidance complicates clinical decision-making and underscores the pressing need for head-to-head trials that could better inform target selection and optimize patient outcomes. Although DBS helps regulate brain activity to ease symptoms, the exact neurophysiological mechanism by which it works is still not well understood, as improving stimulation strategies remains challenging without a deeper understanding of these mechanisms. This absence of robust longitudinal data leaves unanswered questions about the durability of symptom relief over many years, the potential for relapse, and the management of evolving patient needs as DBS recipients age. Sustainability of improvements beyond five to ten years is less specific [5].

Another major challenge lies in identifying which patients are most likely to benefit from DBS. While it is well understood that factors such as symptom subtype, duration of illness, and comorbid psychiatric conditions may influence treatment response, the development of reliable predictive models remains in its infancy. The identification of validated predictive markers would advance patient stratification and enable a more tailored, efficacious, and ethically responsible application of deep brain stimulation (DBS). Developing individualized targeting and stimulation protocols represents a key priority for future research, aiming to align therapeutic interventions with the specific neurobiological profiles of each patient [6]. Without clear predictive frameworks, clinicians face considerable uncertainty when determining candidacy for DBS, potentially limiting access for some patients while exposing others to invasive interventions with uncertain benefit. In addition, ethical considerations regarding consent and management of side effects in vulnerable patients are increasingly discussed but not yet systematically addressed. The theoretical

foundation for DBS in treating OCD is rooted in the cortico-striato-thalamo-cortical (CSTC) circuit model, which posits that OCD symptoms originate from hyperactivity within a closed-loop network comprising the orbitofrontal cortex, striatum, and thalamus. Consistent with prevailing theoretical models, deep brain stimulation (DBS) may facilitate therapeutic benefit by interrupting maladaptive circuit dynamics and re-establishing more functional patterns of neural communication [8]. Recent developments, particularly the use of individualized connectomic targeting via diffusion tensor imaging, have enhanced this framework by enabling researchers to delineate hyperconnected neural networks implicated in obsessive-compulsive disorder (OCD) symptoms on a per-patient basis.[7]. Building on earlier work, new studies have proposed novel strategies for improving DBS outcomes and refining clinical practice. Building upon previous findings, one researcher suggested that integrating deep brain stimulation (DBS) with cognitive-behavioral therapy (CBT) may yield superior therapeutic outcomes compared to the modality used in isolation. It was noted that the symptom relief facilitated by DBS could improve patients' capacity to participate meaningfully in exposure-based therapeutic approaches [6]. This potential synergy between neuromodulation and psychotherapy represents an exciting new frontier for maximizing long-term patient outcomes. Concurrently, several studies have underscored the urgent need to address key ethical challenges, advocating for future research to integrate robust frameworks for long-term monitoring, managing adverse events, and promoting equitable access to care [9]. As DBS approaches broader clinical adoption, integrating these ethical dimensions into both research protocols and clinical guidelines will be essential for safeguarding patient well-being and ensuring responsible innovation.

Overall, this study has conducted a comprehensive examination of how advanced neuroimaging can more effectively target areas within the CSTC network, how long-term functional outcomes can extend beyond symptom scores, and how pairing DBS with psychotherapy may yield even stronger results, all while building upon the foundation of prior research. By including a broader and more diverse patient sample, it also aims to make findings more generalizable and to help shape more inclusive and equitable clinical guidelines for psychiatric neuromodulation. Yet despite the significant strides made over the past two decades, DBS still faces critical hurdles, particularly in refining target selection, ensuring lasting therapeutic effects, and embedding strong ethical frameworks into practice. Moving forward, research must continue to prioritize personalized imaging strategies, rigorous longitudinal patient tracking, and thoughtful ethical considerations. DBS has the potential to transform the lives of those living with the most severe and treatment-resistant forms of OCD, with continued progress in these areas, opening new doors to possibilities researchers are only beginning to understand.

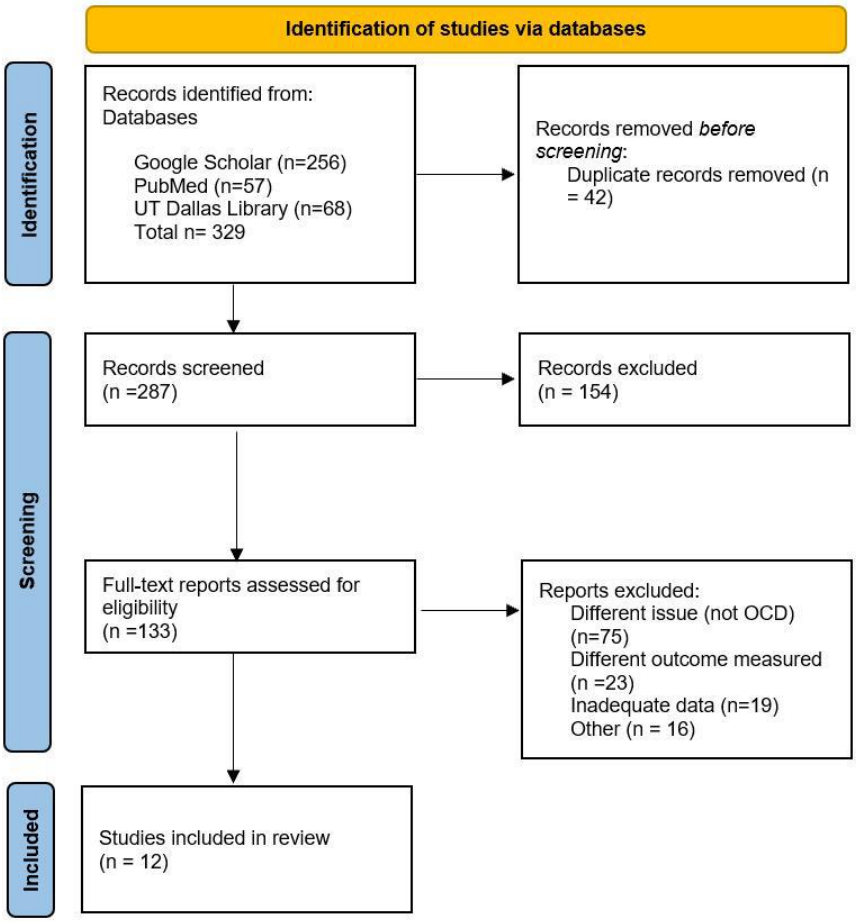

Figure 1. **PRISMA flow diagram—study elimination process.** The PRISMA flow diagram depicts the flow of information through the different phases of systematic reviews and meta-analyses. It maps out the number of records identified, included, and excluded, and the reasons for exclusions.

METHODOLOGY

A systematic search was conducted across the following databases: PubMed, the University of Texas Dallas Library, and Google Scholar. The search criteria included terms and keywords such as "Obsessive-Compulsive Disorder," "Deep Brain Stimulation," "suicide," "sustained long-term outcomes," "treatment efficacy," and "safety." The search limits included studies published between 2010 and 2025. The articles had to be peer-reviewed, written in English, and sourced from a reputable database. The specialized framework called PICO (which stands for patient or population, intervention, comparison, and outcome) was also used as a part of the search to help identify components of the research question. The population was diagnosed with TROCD (treatment-resistant obsessive-compulsive disorder), with the intervention being deep brain stimulation. Comparison was made between DBS and TMS (transcranial magnetic

stimulation) and other forms of TROCD treatments. The outcome was focused on success, safety, long-term effectiveness, and suicide rates post-treatment. The initial search yielded 329 articles that matched the criteria, and after screening for duplicates, 133 remained for further review. After a full-text screening was conducted to assess the content, 12 were deemed eligible. A PRISMA flow diagram was created using a template distributed under the terms of the Creative Commons Attribution (CC BY 4.0) license.

A comprehensive table was created for DBS and TMS articles, which display the following: the study design, the sample size/ demographics of participants, the target locations, and if specified, anesthesia type, recording modality/ recording and stimulation parameters, and if any intraoperative neurophysiological monitoring (IONM) was used.

Treatment Type: Deep Brain Stimulation (DBS)

Study	Study Design	Sample Size & Demographics	Target	Anesthesia	Recording Modality/ Recording & Stimulation Parameters	IONM
Mosley et al., 2021	● Randomized ● Double-blind ● Sham-controlled trial	● 9 Participants ○ 4 Female ● Mean age: 47.9 +/- 10.7	● BNST	General Anesthesia	● Medtronic 3389 quadripolar electrodes ○ Amplitude: 1 Volt ○ Pulse Width: 90 ms ○ Frequency: 130 Hz	-
Nataly Raviv et al., 2020	● Systematic literature review	● 9 Randomized controlled trials ● 1 cohort ● 1 case-control ● 1 cross-sectional ● 16 case series	● ALIC ● VC/VS ● NAc ● BNST ● STN ● ITP ● Caudate Nucleus	-	● Varied	-
Hanyang Ruan et al., 2022	● Systematic literature review	● 17 studies ● Mean Sample Size: 20 participants	● ALIC ● VC/VS ● NAc ● BNST ● STN ● ITP	-	● Electroencephalogram (EEG) ● Functional MRI ● Diffusion MRI ● Local Field Potentials (LFP)	1 study: Welter et al. ○ Microelectrode recordings of STN during implantation
Mar-Barrutiaet al., 2021	● Systematic literature review	● 33 studies ● Short-Term Studies ○ 230 participants ○ Mean Age: 41.7 +/- 9.9 ○ Female: 54% ● Long-Term Studies ○ 155 participants ○ Mean Age: 40.5 +/- 4.3 ○ Female: 61.5%	● ALIC ● VC/VS ● NAc ● STN ● ITP	-	● Varied ○ Frequency: 100-130 Hz ○ Pulse Width: 60-450 µs ○ Voltage: 2-7.4 V ○ Monopolar and Bipolar configurations	-
Raymaekers et al., 2017	● Double-blind, ● Randomized, ● Crossover clinical trial	● 7 Participants: ○ Female: 4 ● Mean age: 50 years	● ALIC ● BNST ● ITP	Local Anesthesia with Sedation	● T2-weighted MRI ● CT Scans ● Medtronic quadripolar leads	-
Denys et al., 2010	● Clinical Trial	● 16 Participants ● Age Range: 18-65	● NAc	General Anesthesia	● Medtronic 3389 quadripolar electrodes ○ Voltage: Mean of 4.3 V ○ Pulse Width: 90 ms ○ Frequency: 130 Hz ● CT Scans	-

Figure 2. **Characteristics of Deep Brain Stimulation (DBS) Studies.** This table outlines essential information for each including DBS study, including study design, participant demographics, target locations, anesthesia type, recording/stimulation parameters, and the use of intraoperative neurophysiological monitoring (IONM).

Treatment Type: Transcranial Magnetic Stimulation (TMS)					
Study	**Study Design**	**Sample Size & Demographics**	**Target**	**Treatment Duration**	**Recording Modality/ Recording & Stimulation Parameters**
Liang et al., 2021	● Systematic literature review ● Meta-analysis ● Randomized control trials	● 22 Randomized control trials ● Age Range: 18-65	● DLPFC ● SMA ● mPFC ● ACC ● OFC	2-6 weeks	● Varied ● Low-Frequency (≤1 Hz) ○ DLPFC ○ SMA ● High-Frequency (≥5 Hz) ○ DLPFC
Luxin et al., 2024	● Systematic literature review ● Meta-analysis	● 15 studies ● 643 participants	● DLPFC (Left) ● SMA (Left) ● OFC (Right)	20 sessions over 4 weeks	● Varied ● 1-2 mA ○ Anode: DLPFC (Left) ● Mean time: 20 minutes
Roth et al., 2021	● Multicenter ● Observational	● 219 participants	● mPFC ● ACC	29 sessions daily for 30 days	
Kamar Kar et al., 2024	● Meta-analysis	● 12 Meta-analyses	● DLPFC ● SMA ● mPFC	10-30 sessions, daily over 2-6 weeks	● H7-coil ● High-Frequency (≥5 Hz) ○ mPFC/ ACC ○ 2000 pulses per session ○ 50 trains of 2-second duration ○ Inter-train interval of 20 seconds
Brunelin et al., 2018	● Systematic Review	● 77 participants	● DLPFC ● OFC ● SMA ● mPFC	10-20 sessions over 2-4 weeks	● 1-2 mA ○ Anode: DLPFC (Left) ○ Cathode: DLPFC (Right)
Lusicic et al., 2018	● Narrative Review	● Varied	● DLPFC ● SMA ● mPFC	10-30 sessions over 206 weeks	● Low-Frequency (≤1 Hz) ● High-Frequency (≥10 Hz)

Figure 3: Characteristics of Transcranial Magnetic Stimulation (TMS) Studies. This table summarizes key details for each, including TMS study, encompassing study design, participant demographics, target locations, treatment duration, and recording/ stimulation parameters.

RESULTS

Several brain regions have been targeted with DBS for treatment-resistant OCD, with the most common targets including the anterior limb of the internal capsule (ALIC), the ventral capsule/ventral striatum (VC/VS), the nucleus accumbens (NAc), and the subthalamic nucleus (STN). These regions are part of the

cortico-striato-thalamo-cortical circuit (CSTC) implicated in OCD pathophysiology. The CSTC circuit is a chain of neurons that connects the prefrontal cortex, basal ganglia, and thalamus in a loop. This is important for limbic (emotion regulation), associative, and sensorimotor information, as well as having a significant role in impulse inhibition. As a result, DBS stimulation of various regions within the CSTC circuit is effective in combating symptoms of OCD. This is measured using the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS). A systematic review of recent studies revealed that stimulation of the STN resulted in the highest mean reduction in Y-BOCS scores and the highest responder rate, demonstrating the highest efficacy for symptom reduction.

DBS Brain Target Efficacy for OCD				
Brain Target	**Number of Participants**	**Mean Y-BOCS Reduction**	**Responder Rate (35% Reduction)**	**Study Reference**
Ventral Anterior Limb Internal Capsule (vALIC)	70	40%	52%	Luyten et al., 2020
Ventral Capsule / Ventral Striatum (VC/VS)	8	31.70%	63%	Mosley et al., 2021
Nucleus Accumbens (NAc)	16	46%	56%	Denys et al., 2010
Subthalamic Nucleus (STN)	19	53.40%	74%	Mallet et al., 2020

Figure 4. Efficacy of DBS Brain Targets for OCD. This summary outlines the neurobiological rationale for targeting specific areas within the cortico-striato-thalamo-cortical (CSTC) circuit for the treatment of OCD. The accompanying table quantifies the clinical efficacy of these targets based on Y-BOCS reduction and responder rates.

DISCUSSION

Suicide Risks and Deep Brain Stimulation (DBS) for Obsessive-Compulsive Disorder (OCD) Individuals diagnosed with obsessive-compulsive disorder (OCD) face a significantly higher risk of suicide compared to the general population. According to a systematic review, OCD increases the odds of suicidal ideation with odds ratios (ORs) ranging from 1.9 to 10.3 and suicide attempts with ORs ranging from 1.6 to 9.9 [10]. The lifetime prevalence of suicidal ideation among OCD patients has been reported to range from 26.3% to 73.5%, while suicide attempts occur in 6% to 27% of cases (Fernández de la Cruz et al., 2016). The presence of comorbid psychiatric conditions such as depression, anxiety, and substance use disorders further exacerbates the risk of suicidal behavior [11]. Deep brain stimulation (DBS) is considered a relatively safe treatment option for individuals with treatment-refractory OCD, cases where standard therapies, including selective serotonin reuptake inhibitors (SSRIs) and cognitive behavioral therapy (CBT), have proven

ineffective. However, the relationship between DBS and suicide risk remains complex and nuanced [12]. An international multi-center study found that only 3.4% of patients undergoing DBS experienced suicidal ideation, with only one reported suicide attempt, and no established causal link between DBS and increased suicidality [13, 14]. Nevertheless, suicidality remains among the most frequently reported severe adverse events (SAEs) in psychiatric DBS interventions [14]. While rare, instances of intracranial hemorrhage and infections have also been observed in this population [15]. Some studies have identified an elevated standardized mortality rate (SMR) among patients receiving DBS; however, direct evidence connecting DBS to increased suicide rates remains inconclusive [16]. Importantly, structured post-operative multidisciplinary care, involving neurologists, psychiatrists, and psychotherapists, including those trained in CBT, has been shown to reduce suicide risk significantly ([17, 18]. One proposed mechanism of concern is that DBS may increase impulsivity, thereby lowering the threshold for suicide attempts in predisposed individuals [19]. Additionally, neuroimmune responses to the implanted device may alter regional brain reactivity in ways that are not yet fully understood [14]. Given the potential risks, it is essential to select DBS candidates carefully. Patients exhibiting active suicidal ideation or suffering from severe psychiatric comorbidities may not be suitable candidates for this invasive intervention [20]. A multidisciplinary approach to care, one that integrates psychiatric, neurological, and psychological expertise, can enhance therapeutic outcomes while minimizing suicide risk [17]. Furthermore, the possibility that DBS may increase impulsiveness emphasizes the need for thorough informed consent procedures and ongoing post-operative monitoring [21].

Invasive vs. Non-Invasive Treatments for OCD

Transcranial magnetic stimulation (TMS) is a non-invasive neuromodulation technique that utilizes magnetic fields to stimulate cortical regions implicated in OCD pathophysiology, including the dorsolateral prefrontal cortex (DLPFC), supplementary motor area (SMA), and orbitofrontal cortex (OFC) [22]. The U.S. Food and Drug Administration approved TMS for the treatment of treatment-resistant OCD in 2018 [23]. Meta-analyses of randomized controlled trials have demonstrated that repetitive TMS (rTMS) is significantly more effective than sham stimulation, with a moderate effect size (Hedge's g = 0.65) [24]. Deep TMS (dTMS), which utilizes H-coils to target deeper brain structures, has shown a 38% response rate in a multicenter, randomized, controlled trial. Real-world data indicate sustained symptom improvement in 52.4% of patients after 20 sessions [25]. Low-frequency TMS applied to the SMA and OFC has been shown to alleviate OCD symptoms, and high-frequency stimulation of the DLPFC has also demonstrated potential, albeit with more limited supporting evidence [26, 27]. While response rates for TMS range between 30% and 55%, these variations are likely due to differences in stimulation protocols and patient characteristics. Despite its FDA clearance, ongoing research continues to explore optimal stimulation targets, frequencies, and coil types [28]. Transcranial direct current stimulation (tDCS) is another non-invasive method that delivers a low-intensity electrical current to modulate cortical excitability. Though it offers less spatial precision than TMS, tDCS is being investigated as a cost-effective and portable treatment option. Cathodal stimulation over pre-SMA has demonstrated greater efficacy than anodal stimulation in symptom reduction

for OCD patients [27, 29]. A systematic review and meta-analysis concluded that tDCS significantly reduces scores on the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS), with effects sustained for up to one month [30]. The technique is generally well-tolerated, with only minor and transient side effects such as tingling, redness, or scalp irritation. Preliminary data also suggest that tDCS may be safe for use during pregnancy, though larger-scale trials are needed to confirm this [31]. Deep brain stimulation (DBS) remains the most extensively studied invasive neuromodulation strategy for severe, treatment-refractory OCD. The procedure involves the surgical implantation of electrodes into specific brain regions, such as the anterior limb of the internal capsule (ALIC), the nucleus accumbens (NAc), and the subthalamic nucleus (STN), and has received FDA approval under Humanitarian Device Exemption [32]. Meta-analyses have reported that DBS produces an average Y-BOCS score reduction of 40–50%, with clinical response rates, defined as a ≥35% reduction in Y-BOCS scores, ranging from 40% to 60%.

Some studies have even reported remission rates as high as 70% [4, 16]. Long-term follow-up data confirms that symptom relief can be sustained for several years [15]. The therapeutic effects of DBS are believed to result from modulation of the cortico-striato-thalamo-cortical (CSTC) circuit, in which the ALIC, NAc, and STN are key nodes. Stimulation within this circuitry appears to alter functional connectivity in a way that alleviates OCD symptoms [15]. Although DBS is generally considered safe, adverse events such as wound infections (4.3%), hypomanic symptoms (19.8%), and memory complaints (7.8%) have been documented. However, these effects are usually mild and reversible [4]. Despite its efficacy, DBS remains a costly and invasive procedure that is typically reserved for the most severe cases. Insurance coverage remains a significant barrier, with fewer than 40% of eligible patients receiving approval [33].

CONCLUSION

Deep brain stimulation presents a powerful and promising treatment for individuals with severe, treatment-resistant OCD, offering hope where traditional therapies have failed. While it carries certain risks, including potential adverse effects and ethical considerations, the long-term outcomes, such as significant symptom reduction and improved quality of life, make it a valuable option for selected patients. Continued research and careful patient selection, along with integration of non-invasive alternatives like TMS and tDCS, will be crucial in shaping the future of psychiatric neuromodulation.

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