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# Treatment of Psychiatric Diagnoses with Ultra Brain Stimulation

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## Abstract

Although neurostimulation procedures have been available for a while, they have just recently moved to the forefront of research and therapy. Spinal cord stimulation, cochlear implantation, and bionic eye technology are all potential uses for brain and neurostimulation, but there are big distinctions in how well-suited each of these uses is for clinical use.

**Keywords:** Neurostimulation; Spinal cord; Cochlear implantation; Bionic eye technology

## Introduction

For a variety of neurological conditions, electrical high-frequency deep brain stimulation has been created as an alternate therapeutic option. However, the use of DBS has moved beyond therapeutic to research goals as surgical methods, techniques, and safety precautions have improved. Although the precise mechanism of action is still not entirely known, the findings of recent clinical studies and active research are promising. Since 1997, essential tremor, Parkinson's disease, and dystonia have all been treated using DBS. Major depression is among the disorders it is used to treat. The therapeutic effectiveness of DBS in treating PD is well established; however the outcomes in treating other conditions, such epilepsy, are ambiguous and uncertain. A brief review of the literature on Parkinson's disease, epilepsy, and obsessive-compulsive disorder is presented in this article.

The first people to record the impact of electrical impulses on the nerve system were possibly the ancient Romans and Greeks. The Greeks gave the same animal the name Narke because it stuns prey. In AD 47, Claudius Scribonius Largus used living rays to alleviate headaches. Later, the same approach was utilised for epilepsy, gout, depression, and haemorrhoids. Avicenna (AD 980–1037) claimed that the brain is not as homogeneous as previously believed, but a breakthrough was made possible by the discoveries and subsequent research of German neurologist Edward Hitzig in 1864. Without using any kind of anaesthetic, anatomist Fritsch sent electrical impulses to dogs' exposed brain cortex [1]. Bartholoff electrified a terminally ill patient in 1874, not long after the new era of brain stimulation started in Cincinnati, whose scalp and skull had been worn down by basal cell cancer. These tests produced contralateral movement and were successful. Quadrupolar electrodes on his current DBS device are usually placed inside the brain. An internal pulse generator is implanted on top of or inside the pectoral fascia while aligned extensions are passed behind the ear [2]. Technology nowadays is advancing at an unimaginable rate. Bionic eyes are also advancing, and cochlear implants are now in use. Similar to a cardiac pacemaker, his DBS device might be remotely programmed over the phone or online.

The most prevalent type of central nervous system disease that progresses and degenerates is PD (CNS). Globally, 10 million people have received a PD diagnosis, but this number does not account for the millions of undiagnosed instances [3]. It is becoming increasingly difficult to compare the prevalence and incidence of PD in other parts of the world because so many variables, such as gender, age, diagnostic criteria, and medical institutions, affect these statistics. Early Parkinson's disease symptoms include slow movements (bradykinesia), resting tremors, stiff muscles, shuffling, and slumped posture. These symptoms are brought on by dopaminergic neurons dying in the Substantia Nigra pars compact (SNpc). Cause intracellular inclusions known as Lewy bodies to develop in the midbrain. Parkinson's disease can cause a wide range of non-motor symptoms, such as autonomic, sensory, sleep, cognitive, mental, and dementia, in its late and sometimes early phases [4]. The goal of neurostimulation is to restore a nerve's or muscles physiological function by carefully targeting and electrically stimulating the afflicted location. Deep Brain Stimulation (DBS) has been used to improve motor function and, to a lesser extent, cognition in Parkinson's disease patients without dementia who are receiving little to no pharmaceutical treatment in late-stage Parkinson's disease.

DBS involves the long-term implantation of electrodes and the continuous application of high frequency electrical stimulation pulses to particular brain areas. These surgically implanted leads feature lead extensions and pulse generators. In order to provide different treatment options, percutaneous programmers are also used [5]. Parkinson's disease is hypothesised to have hyper activated Sub Thalamic Nuclei (STN) and globus pallidus (GPi), which are the main targets of DBS. Although the ventricular intermediate nuclei of the thalamus are occasionally targeted, the STN is the most typical area for DBS. Although the exact mechanism of DBS is unknown, it appears to depend on the control of neuronal activity, which eliminates and swaps out abnormal patterns in the basal ganglia for less disruptive ones [6]. DBS provides an alternative to conventional PD therapies. Although PD-related dementia cannot be treated with it, it is extensively used and known to considerably alleviate PD symptoms, including pain alleviation and cognitive impairment.

A wide range of chronic neurological illnesses called epilepsy are linked to repeated seizures. At least two epileptic seizures must be repeated, or one seizure must cause brain changes that could make future seizures more likely. Epileptic seizures are brought on by excessive, unusual, or hyper synchronous neuronal activity in the brain. More than 50 million people worldwide, especially in underdeveloped nations, have epilepsy. Medication can manage about 70% of epileptic

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seizures, but for the other 30%, it has little to no effect. Surgery or DBS may therefore be considered [7]. When medicine and surgery are ineffective for treating refractory epilepsy, electrical stimulation of the Vagus Nerve (VNS) is utilised as a treatment option. Uncertainty surrounds the Mechanism of Action (MoA) of VNS in the management of seizure control. Acetylcholine, inhibitory neurotransmitters, excitatory neurotransmitters, and other neuropeptides are all used by vagal afferent synapses. The nuclear sorus receives the majority of Vagal Afferent Synapses (NTS) [8]. To control the release of norepinephrine and serotonin, NTS projects to various brainstem nuclei, including the LC and Raphe Magnus. These neurotransmitters ultimately have an impact on both hemispheres' limbic, reticular, and autonomic regions [9]. According to a supposition, afferent vagal synapses reduce seizure activity by altering neurotransmitters. The cervical spine receives electrical impulses from the implanted device. Important functions in VNS MoA are played by intracranial and brainstem structures along the anatomical pathway from the place of stimulation to the cortex. Includes the thalamus limbic system, locus coeruleus, and NTS.

OCD is a brain and behavioural condition caused by anxiety that manifests as thoughts, discomfort, fear, and worry. OCD sufferers engage in repetitive behaviours to ease their uneasiness. or by a mix of the compulsions and obsessions. Excessive washing and cleaning, dominance, hoarding, and fixation with sexual, violent, or religious thoughts are examples of repetitive behaviours. In any case, routine academic tasks, religious rituals, and daily life are not restrictions [10]. The Orbitofrontal Cortex (OFC), ventral-mesoprefrontal cortex (PFC), Dorsal Anterior Cingulate cortex (DAC), and related Cortico-Striatal-Thalamocortical (CSTC) circuits, which include the basal ganglia and thalamus, are all involved in OCD. It appears that a connectivity issue is the root of the problem. The prevalence of OCD is 2% worldwide, and 20–40% of individuals experience persistent symptoms that result in long-term disability [11, 12]. Despite the effectiveness of current therapies (selective serotonin reuptake inhibitors, cognitive behavioural therapy, surgical excision, etc.), 10% of patients do not respond to them. These patients would respond well to DBS and would gain from it.

The Ventral Capsule/Striatum (VC/VS), the inferior thalamic peduncle (ITP), and the forelimbs of the internal capsule are additional options for future study. The STN is now the stimulation target. Each site has advantages and disadvantages, thus more investigation and testing are needed [13]. Parkinson's disease is commonly treated with STN stimulation, which has been proven effective and minimises surgical risks. Contrarily, VC/VS stimulation uses less stimulation energy, extending battery life and minimising postoperative adverse effects. The outcomes of this therapy are encouraging. Four out of six patients in two studies exhibited a significant decrease in their Y-BOCS (Yale-Brown Obsessive Compulsive Scale) score, but more extensive study is required to determine the treatment's effectiveness and safety [14].

The Tourette syndrome, also known as Tourette illness, Gilles de la Tourette syndrome, GTS, or simply Tourette syndrome or TS, is an inherited neuropsychiatric disorder that manifests in childhood. Tourette syndrome may be treated with DBS. Multiple physical (motor) tics and at least one verbal (phonic) tic are features of this neuropsychiatric illness [15]. It is only advised for instances that have failed all other treatments because this surgery is invasive and Tourette's disorder affects children more frequently than adults.

## Conclusion

Patients have found implantable neuromodulatory devices to be very helpful, and their therapeutic uses are expanding quickly. Studies and clinical examples have repeatedly demonstrated its effectiveness in treating brain disorders. DBS has now been applied to various areas of medicine, psychology, and nutrition thanks to the knowledge and expertise obtained. Precise modulation of neurotransmission and downstream neurochemical cascades using both invasive DBS and non-invasive, such as transcranial magnetic stimulation, has proven to be a severe problem for the future. These devices enable many stimulation techniques and can focus stimulation on very particular CNS foci. Both inhibitory and/or excitatory effects may result from this.

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## Conflict of Interest

The author declares has no conflict of interest.

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