

# Deep Brain Stimulation: The Future of Mental Illness Treatment in India

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## Abstract:

Mental illness is a health issue that affects a large number of people globally and the hefty amounts of money being spent on the management and treatment of mental illness are alarming. With recent years, a substantial number of mental illness patients have shown no improvement on the available mental illness interventions. Deep brain stimulation (DBS) is a technology that has shown tremendous results in the treatment of movement disorders. Recent research has tried to explore this technology on treatment-resistant mental illness and the results have been promising. This review looks into DBS as the promising future in the treatment of mental illness in India.

**Keywords — deep brain stimulation, obsessive compulsive disorder, Tourette’s syndrome, major depression disorder**

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## I. INTRODUCTION

In the past decades, deep brain stimulation (DBS) has shown tremendous success in the treatment of movement disorders, i.e. essential tremors, Parkinson’s disease, and dystonia. DBS involves the implantation of electrodes within certain areas of the brain for the purpose of regulating abnormal electrical impulses (Mayo Clinic, 2021). Recent research has shown promising success in the use of DBS for the treatment of severe mental illness. With the advantage of reversibility and adjustability, DBS promises a future in the treatment of mental illness. According to the World Health Organisation (n.d.), the incidence rate of mental health conditions and substance use disorders has been on the rise, reporting 13% increment in the last decade to year 2017. In India, mental disorders have been among the leading causes of non-fatal disease burden. This essay will provide a comprehensive enlightenment on the use of DBS in the treatment of mental illness

disorders, as well as envision the future of DBS use in the treatment of mental illness in India.

## II. DESCRIPTION OF DEEP BRAIN STIMULATION AND HOW IT WORKS

Deep brain stimulation involves the application of high-frequency electrical stimulation to specific areas of the brain for the regulation of abnormal electrical impulses. Electrodes are implanted at the precise brain site with abnormal signals to deliver electrical stimulation pulses at a high frequency for the regulation of the brain’s electrical activity. The electrodes are thin, insulated wires which are surgically inserted through a small opening in the skull and implanted at the targeted region of the brain (Pilitsis et al., n.d.). An extension wire that passes under the skin of the head, neck, and shoulder, connects the electrodes to an internal pulse generator (IPG) located under the skin in the upper chest. The IPG is programmed for the amount of stimulation required at the targeted brain areas. The high-

frequency stimulation alters the abnormal neuron signal of the basal ganglia or the thalamus, thus alleviating illness symptoms. According to Rezak (n.d.), a neurologist from Northwestern Medicine, the electrical impulses sent by the electrodes help block faulty signals within the brain that cause illness symptoms.

### **III. DBS EDUCATION IN INDIA**

Since the first DBS surgery in 1999 in India, application of this treatment method has undergone steady expansion in the country. DBS has been deemed as one of the most effective treatments of movement disorders with the least side effects. It is reported that about 500 DBS surgeries are performed annually in India (Kakkar, 2021). However, DBS surgery for mental disorders are quite rare in India. The mental health legislation of India permits psychosurgery under certain restrictions communicated under the section 96 of the Mental Healthcare Act, 2017. The Act states that psychosurgery shall not be performed as a treatment for mental illness unless informed consent of the person on whom the surgery is being performed is obtained, and approval from the concerned Mental Health Board to perform the surgery has been granted (Doshi et al., 2019). Lack of information with medical practitioners continues to be a limiting factor for access to DBS. This limiting factor was also confirmed by a survey conducted by Zhang and his colleagues (Zhang et al., 2020).

### **IV. THE FUTURE OF DBS IN THE TREATMENT OF MENTAL ILLNESS IN INDIA**

It is true that pathogenesis of psychiatric disorder is not fully understood. However, research has discovered that a number of the severe psychiatric disorders results from malfunctions in the limbic system and the basal ganglia. For instance, the psychogenesis of OCD (obsessive compulsive disorder); functional neuroimaging studies implicates the frontal-basal brain networks for OCD.

OCD is characterized by persistent and recurrent intrusive thoughts, images, or impulses that are experienced as disturbing, inappropriate, and uncontrollable coupled with overt repetitive behaviours that are performed as lengthy rituals (Hooley et al., 2017). Untreated OCD patients' studies show increased glucose metabolism or blood flow in the medial and orbitofrontal cortex (OFC) and anterior cingulate gyrus, the caudate nucleus, and, to a lesser extent, the thalamus. This implies a dysregulation in the basal ganglia and limbic striatal circuits that modulate neuronal activity in and between the OFC and the dorsomedial thalamus (Tarsy et al., 2008). Treatment with DBS targets the implicated areas of the brain, reducing drives to engage in repetitive, stereotyped behaviours and alleviating the negative emotional charge associated with induction of such behaviours. In the same way, DBS in Tourette's syndrome targets the thalamus (including centromedian-parafascicular complex, dorsomedial nucleus, ventro-anterior and ventro-lateral) and the globus pallidus internus (including the motor and associative-limbic parts). For both targets, recent meta-analysis have proven efficiency of DBS in improving tic symptoms (Clair et al., 2018).

The inception of DBS technology was mainly aimed at the treatment of movement disorders. The effectiveness and level of safety of this technology has led researchers to explore the possibilities of exploring it in the treatment of mental disorders. Some of the mental disorders that show promise with the treatment of DBS include obsessive-compulsive disorder (OCD), major depression disorder (MDD), and Tourette syndrome (TS). Studies and clinical trials have shown DBS as a promising intervention for treatment-resistant psychiatric disorders. Open-label studies have shown that up to 90% of OCD and MDD patients who are unresponsive to therapy or medication have reported benefit from DBS (Sullivan et al., 2021). Two recent meta-analyses found that DBS leads to a global decrease of about 45% of OCD symptom severity with 60% of patients considered responders (Clair et al., 2018).

## V. CONCLUSIONS

In conclusion, mental illness has been and continues to be an economic burden in India. Government funds directed to the management and treatment of mental illness on annual basis are extremely high. Although the inception of DBS technology was intended for movement disorders, it promises the solution to curbing these economic constrains and ensuring improved quality of life for people with mental illness in India. Research data displays hopeful potential for the future of mental disorders in the use of DBS. However, further investigations are still paramount on the long term effects of the procedure to avoid any further complications of the conditions.

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