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Importance and Effectiveness of Brain Stimulation in the Treatment of Depression and Insomnia

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Abstract

Title: Importance and effectiveness of brain stimulation in the treatment of depression and insomnia.

Objectives: This article is to show the importance of brain stimulation in the treatment of depression and insomnia. Also to reduce the prevalence of depression and insomnia, to show the relationship between depression and insomnia, to bring for a solution to suicide caused by depression, to explore the use of brain stimulation in the treatment of depression and insomnia, to know the effectiveness and side effects of brain stimulation in the treatment of depression and insomnia. But most important purpose of this article is to show the importance and effectiveness of brain stimulation in the treatment of depression and insomnia.

Methods and Findings: We went through about 15 articles published from 2006 till date. We used the key phrase brain stimulation in the treatment of depression and insomnia. We reviewed journals from PubMed/Medline, WHO factsheet, psychology today, NIMH (National Institute of Mental Health). We also retrieved articles from journals of physicians, NIMH Researchers, John Hopkins School of Medicine researchers. We acquire results from 7 experiments carried out by psychologists, researchers on the use of deep brain stimulation and cranial electrotherapy for the treatment of depression and insomnia, there were positive results but some of the positive results took time to manifest while some of the experiments didn't have a positive result. This was dependent on the stage of the depression. Further down this article we talked more about the result.

Conclusion: In this article it was concluded that deep brain stimulation and cranial electrotherapy can be used to treat depression and insomnia but it doesn't work for every one or it might take longer to bring forth a positive outcome. Therefore further research should be carried out on the use of deep brain stimulation and cranial electrotherapy to cater for different stages of depression and insomnia.

Keywords: Brain stimulation; Depression; Insomnia; Cranial electrotherapy; Psychologists

Introduction

Depression is a mood disorder that causes a persistent feeling of sadness and loss of interest. It is also called major depressive disorder or clinical depression [1]. Insomnia is a persistent disorder that can make it hard to fall asleep [2]. WHO estimates 350 million people of all ages suffer from depression [3].

Deep brain stimulation is the surgical implantation of electrodes in specific parts of the brain. Cranial electrotherapy stimulation is the stimulation of the cranium and the brain with a current a patient can't feel. This device looks like a cellphone. The research is observing the use of deep brain stimulation and cranial electrotherapy and its role in the treatment of depression, tremor, anxiety and insomnia, but we are focused on depression and insomnia.

In the early 1950s, doctors used brain stimulation in the aspect of lesioning or destroying part of the brain to control certain motor function especially in Parkinson disease [4]. But in the process of using this treatment method it was found to have to irreversible effect on the patient due to the permanent destruction of parts of the brain [4].

Deep Brain Stimulation

This procedure was introduced in 1987; it consists of the use of a neuro-stimulator also known as 'brain pacemaker' which transmits electrical impulse to brain nuclei [5]. It has provided therapeutic benefits for major depression [5] and its effects are reversible unlike using deep brain stimulation to destroy (lesioning) parts of the brain in Parkinson patients [5]. Deep brain stimulation on depressed patients actually regulates abnormal impulse [6]. The electrodes are implanted in the parts of the brain that regulates moods. These is the emotion regulating circuit which are the thalamus, anterior cingulate, ventral striatum and orbitofrontal cortex and these areas are overactive due to tryptophan depletion [7]. A brain imaging study by the NIMH's National Institute of Mental Health (NIMH)

has found that an emotion-regulating brain circuit is overactive in people prone to depression even when they are not depressed [7]. In depressed patients the reason why deep brain stimulation is important is because according to NIMH (National Institute of Mental Health) people with depression have their chemical messenger reduced, Tryptophan is reduced which is a precursor for serotonin and serotonin is boost by antidepressant [7]. Deep brain stimulation is not frequently used in treatment of insomnia.

Cranial electrotherapy stimulation

Cranial Electrotherapy also known as “Electro Sleep Treatment.” Stimulation utilizes a device that looks like a cell phone, it has weak electrical current (<4 mA) which sends impulses to the brain via ear lobes, maxilla occipital junction, mastoid process and temples [8]. An average level of treatment is usually 20-60 minutes also daily treatments are recommended during the first 3-8 weeks [8]. It is non-invasive and it treats depression and insomnia spontaneously.

It is a simple procedure that can be done at any time, it leave the users alert while inducing a relaxed state psychologists call this an alpha state, it actually differs from pharmaceutical treatment in people reporting that they feel relaxed. When undergoing CES most people experience a feeling that their bodies are lighter, while thinking is clearer and more creative although some people may experience Euphoric feeling for up to several hours after treatment. It is generally believed that the effectiveness of CES is experimental. The effects are majorly mediated through a direct action on the brain at the limbic system.

Literature

- Depression is a mood disorder that causes a persistent feeling of sadness and loss of interest. Also called major depressive disorder or clinical depression [1].
- Insomnia is a persistent disorder that can make it hard to fall asleep, hard to stay asleep or both, despite the opportunity for adequate sleep [1].
- Importance of cranial electrotherapy stimulation in treatment of depression and insomnia.
- Deep brain stimulation: Experimental new approach for treatment resistant depression [11].
- WHO estimates 350 million people of all ages suffer from depression.

Materials and Method

We used the key phrase brain stimulation in the treatment of depression and insomnia. We went through about 15 articles published from 2006 till date. We reviewed journals from PubMed/Medline, WHO factsheet, psychology today, NIMH (National Institute of Mental Health). We also retrieved articles from journals of physicians, NIMH Researchers, John Hopkins

School of Medicine researchers. From all the articles we retrieved, we reviewed all and we are able to get the importance, side effects, and methods on the use of deep brain stimulation following the results gotten from the retrieved articles.

Results

While we were reviewing other articles, the use of deep brain stimulation and cranial electrotherapy stimulation has yielded some results. These results were collected from patients that suffer mainly from depression and few from insomnia. All the results collected from the use of these brain stimulators lead the patient to being able to control their mood and leaving them euphoric and light hearted. It proves that brain stimulators are useful in the treatment of treatment resistant depression and insomnia.

Discussion

As outlined in **Table 1**, there are results for the use of brain stimulation in the treatment of depression and insomnia. We reviewed up to 15 articles but we are going to base our result discussion on 7 recent articles. The first on the table that is based on depression traced to overactive brain circuit and its source is science daily. The NIMH researchers based their research that the cause of depression is tryptophan depletion in the emotion regulating circuit. So 27 depressed patients were selected at random and given the actual pill to increase tryptophan and 19 patients in controls were given placebo that is essential amino acids such as lysine and valine and 16% had smooth return to normal behavior from symptoms of tryptophan depletion and this was a blind study research [6]. The next study was on Deep Brain Stimulation for Depression by Kelly Colihan (Web MD health news), Reviewed by Brunilda Nazario. This is an article of July 28, 2008; they used 20 patients with major depressive episodes. 6 of the patients were treated in 2005 and the remaining 14 were followed up for a year [9]. The results for the deep brain stimulation in these 20 patients were that the patients had improved moods; they were more motivated and interested in life [9]. These researchers concluded that this treatment is best for depression that leads to suicide [9]. The research on treating depression with electrodes by Dr. Sanjay Gupta and Andy Segal [9]. The result in this article is based on a lady named Edi Guyton who at the age of 19 years tried to commit suicide and she suffered major depression for 40 years. She finally volunteered for the deep brain stimulation experiment. The electrodes were implanted in a small area of her brain called area 25 which is in charge of emotions and mood. All this was an experiment of Dr. Helen Mayberg. But her experiment didn't seem to work on Edi Guyton, because Edi Guyton couldn't be happy. But in her research she found out applying electrodes to area 25 doesn't help all patients while some improve in a period of six months or more [10].

Table 1 Use of brain stimulation treatment.

| Topic | Source |
|--|--|
| Depression traced to overactive brain circuit | Science Daily |
| Deep brain stimulation for depression | Web MD health news), Reviewed by Brunilda Nazario |
| Treating depression with electrodes | Dr. Sanjay Gupta and Andy Segal |
| Treating depression with deep brain stimulation | Eugene Rubin Psychology Today |
| Brain differences linked to insomnia | Racheal E Salas John Hopkins School of Medicine |
| Cranial electrotherapy stimulation for treatment of anxiety, depression and insomnia | Daniel L Kirsch, Francine Nichols |
| Deep brain stimulation | United Health Oxford |

Treatment of depression with deep brain stimulation

A study of 20 patients showed a 60% response rate at 1 year and reduction rate around 50%-results that were maintained over numerous years. Of note, most symptoms of depression and insomnia have shown remission rates ranging from 33% to 58% with deep brain stimulation [11]. A case report showed efficacy for patients who are depressed. In one study, blinded discontinuation was linked with increase in depression as opposed to when deep brain stimulation was reinstated and from these studies no adverse effect was seen with chronic or acute deep brain stimulation [11].

Brain differences linked to insomnia from Johns Hopkins Medicine, 2014

Johns Hopkins researchers report states that people with chronic insomnia show more plasticity and activity than good sleepers in the part of the brain that controls movement [12]. The research team found that the motor cortex in chronic insomniacs is more adaptable to change-more plastic- than in a group of good sleepers [12]. All this points to the fact that insomniacs are in a constant state of sharp information processing that may interfere with sleep [12]. A study included 28 adult participants-18 insomniac and 10 good sleepers [12]. Each participant was provided with electrodes on their dominant thumb as well as an accelerometer to measure the speed and direction of the thumb [12]. After training the participants for 30 minutes, teaching them to move the thumb in the opposite directions of original movement [12]. The researchers found more plasticity in the brains of those with chronic insomnia [12].

Cranial electrotherapy stimulation for treatment of anxiety, depression and insomnia

Forty of the 48(83%) responded positively to CES. During 3 months of CES there was a decline of 41% [13]. Overall 32 of 48 patients were discharged from the hospital and none returned for at least 2 years [13]. Five of the central nervous system trauma has improved [13]. Among 7 patients previously incompetent to standard trial, 6 who responded to CES have been found competent [13].

Conclusion and Recommendation

Some studies show the use of Deep brain stimulation for treating not just depression and insomnia but also conditions like; Parkinson's disease (PD), Obsessive-Compulsive Disorder (OCD), epilepsy, Tourette syndrome, cluster headache, impulsive or violent behavior, stroke pain and movement disorders of Multiple Sclerosis (MS) [15]. However, because of limited studies, small sample sizes, weak study designs and heterogeneous patient characteristics, there is insufficient data to conclude that deep brain stimulation is effective for treating these indications [15]. Deep brain stimulation is not frequently used in treatment of insomnia [15].

So in conclusion, deep brain stimulation and cranial electrotherapy have been shown to have more positive than negative result in the treatment of Depression and Insomnia [14]. Deep brain stimulation according to NIMH has side effects such as bleeding in the brain or stroke, infection, disorientation or confusion, unwanted mood changes, movement disorders, light-headedness, trouble sleeping [14].

So we think this treatment can be used for treatment resistant depression and insomnia. Although it is not certain that this treatment can work for all or it might take longer to give a positive outcome but it is worth giving a trial. Further research is required on the use of deep brain stimulation and cranial electrotherapy for the treatment of different stages of depression and insomnia. This is to facilitate more positive outcomes gotten from the use of this treatment.

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