



# DEEP BRAIN STIMULATION OF THE SUBCALLOSAL CINGULATE GYRUS IN THE TREATMENT OF TREATMENT RESISTANT DEPRESSION

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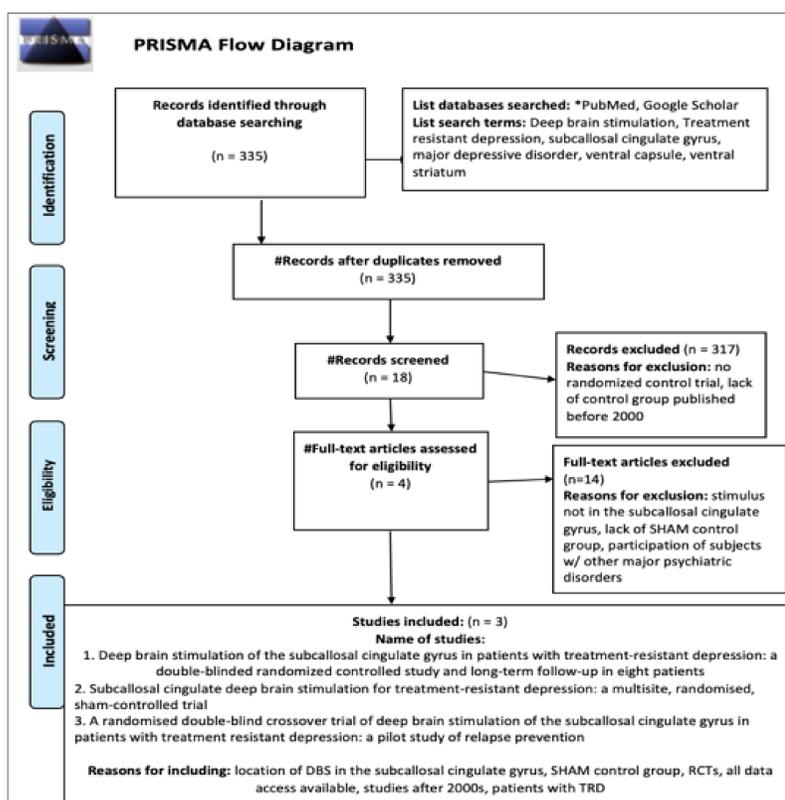
## INTRODUCTION

- MDD affects people of all ages, genders, and nationalities with a prevalence of 4.7% worldwide and 7% in the United States.<sup>1,2</sup>
- Numerous treatment modalities for TRD exist including pharmacotherapy, psychotherapy, and electroconvulsive therapy, yet none are 100% guaranteed to relieve patient symptoms and improve overall quality of life.
- A new and emerging treatment option for TRD is DBS, an invasive procedure in which one or more electrodes are implanted into the brain through utilization of a stereotactic frame and magnetic resonance imaging.
- The SCG is one of the main surgical targets for DBS in the treatment of TRD.
- It has been predicted that high frequency stimulation of the SCG via DBS could potentially reverse the pathological increased metabolic activity evident in depression.<sup>3</sup>

## CLINICAL QUESTION

IN PATIENTS WITH TREATMENT RESISTANT DEPRESSION, CAN DEEP BRAIN STIMULATION OF THE SUBCALLOSAL CINGULATE GYRUS PROVIDE SYMPTOM RESOLUTION AS A REASONABLE ALTERNATIVE TREATMENT TO CONTINUED PHARMACOLOGICAL THERAPY?

## METHODS



## RESULTS

TABLE 1. Comparison of Review Studies

|   | Study 1<br>Merkl, et al. <sup>4</sup>   | Study 2<br>Holtzheimer, et al. <sup>5</sup>  | Study 3<br>Puigdemont, et al. <sup>6,7</sup>  |
|---|---|--|---|
| <b>Objective</b>                                      | To compare the efficacy of delayed onset DBS vs. non-delayed DBS to improve patient depression scores.  | To determine the safety and efficacy of DBS in the treatment of chronic, unremitting TRD   | To confirm the efficacy of DBS in TRD; to determine the effect of withdrawing stimulation of patient relapse  |
| <b>Study Type and Stimulation Protocols/ Overview</b> | <b>RCT</b> ; immediate stimulation vs delayed stimulation. All participants received active DBS after 4 weeks.  | <b>Prospective, double blind, sham-controlled RCT.</b> Sham vs active stimulation lasted 6 months. At 6 months, all participants received active stimulation   | <b>Randomized, double blind crossover study</b> looking at relapse rates in patients who had already achieved remission with DBS. ON-OFF vs OFF-ON                          |
| <b>Sample Size</b>                                    | 8   | 90   | 5   |
| <b>DBS Location</b>                                   | SCG   | SCG  | SCG   |
| <b>Primary Depression Scale</b>                       | HAMD-24   | MADRS, GAF   | HAMD-17   |
| <b>Follow Up</b>                                      | 6 participants were followed for 28 months and 2 were followed for 4 years  | All participants were followed for a total of 12 months  | All participants were followed for a total of 6 months  |
| <b>Results/ Conclusion</b>                            | <u>HAMD-24</u><br>-4 weeks: <b>No significance</b> found between delayed and immediate stimulation groups<br>-8 weeks: <b>no significance</b> seen<br>-12 mo: <b>no significant</b> decrease in scores<br>-24 mo: <b>statistically significant</b> score reduction seen for all participants. <b>No significance</b> comparing delayed vs active group. | <u>MADRS</u><br>-6 mo: <b>no significance</b> seen between groups<br>-12 mo: moderate reduction in scores seen in both groups, but overall <b>not significant</b><br><u>GAF</u><br>-6 and 12 mo: <b>statistically significant</b> improvement in depression and global functioning | <u>HAMD-17</u><br>-3, 6 mo: <b>statistically significant</b> difference in scores was observed at the end of both 3 and 6 months comparing the ON groups to the OFF groups. |

**KEY:** DBS: deep brain stimulation; TRD: treatment resistant depression; SCG: subcallosal cingulate gyrus; MDD: major depressive disorder; HAMD: Hamilton depression rating scale; BDI: Beck's Depression Inventory; MADRS: Montgomery-Åsberg Depression Rating Scale; GAF: Global Assessment Functioning

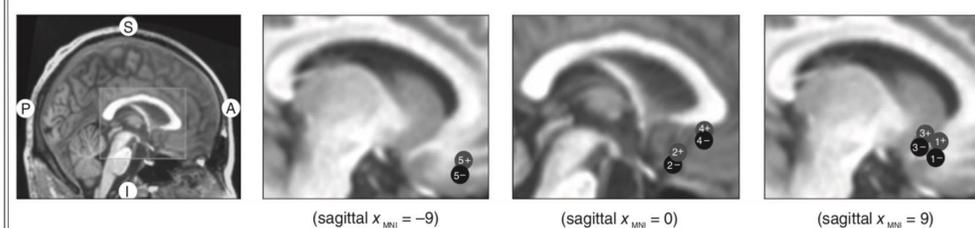


Figure 1. Location of electrode contacts on a sagittal view of the SCG<sup>6,7</sup>

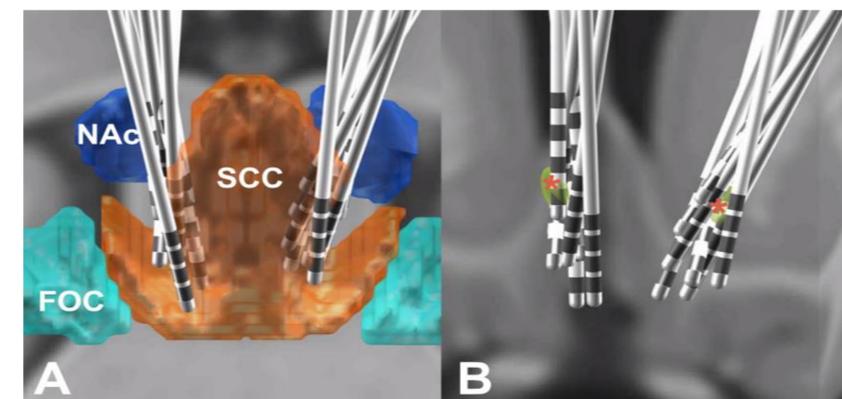


Figure 2. Visualization of DBS lead placement within the subcallosal cortex (SCC).<sup>4</sup> FOC: frontal orbital cortex. NAC: nucleus accumbens

## CONCLUSIONS

- Limited treatment options currently exist for patients with unrelenting major depressive symptoms that are refractory to antidepressant medication use or CBT.
- While some studies have shown moderate benefit of DBS in the SCG, further studies are necessary to determine the overall efficacy and long term benefits of DBS as treatment for TRD.
- Although evidence exists that DBS may be an effective option for treating TRD, it is important to consider such therapy with caution, based on the individual patient, the severity of symptoms, and ultimately the patient's quality of life.
- It is presumed that DBS may serve as a probable option in patients in whom antidepressant medications and CBT have been ineffective for treating major depressive symptoms.

## ACKNOWLEDGMENTS

We would like to thank Dr. Abby Massey and Carolyn Shubert with JMU Libraries for their guidance throughout this project.

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