Development of Novel Stimulator To Reduce Electromagnetic Interference During Transcranial Magnetic Stimulation

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Transcranial Magnetic Stimulation (TMS) is a form of neuromodulation used to treat depression, obsessive-compulsive disorder, migraines, Parkinson's Disease, anxiety, and PTSD. Outside of clinical applications, TMS is used to investigate the pathways of the brain by stimulating specific parts and observing the response, and is used on small animals such as mice and rats before it is implemented in humans. Applications of TMS require extreme focality of the stimulation area. However, current TMS devices fail to reach the precision to stimulate specific areas of the brain with a radius <3 mm. As a result, they often stimulate extraneous areas of the brain, interfere with implants in the brain, and are too imprecise for testing on small animals. The goal of the study is to produce a novel design for a TMS stimulator that is precise enough to stimulate areas <3 mm radius for use in small animal heads, research scenarios, and highaccuracy. To do so, ferromagnetic cores were designed to improve the focality, and core designs were iterated to increase accuracy. To test the accuracy of the designs, they were imported in ANSYS Maxwell and the radius of the stimulation area was measured by plotting the electric field in V/m. The final design iteration produced a highly-focal stimulation area (0.9 mm radius) using a sharpened C-shape core. This focality has not been reached before and implementing this design will allow wider scope of TMS applications and safer TMS therapy.

Awards Won: