The Effect of Rat Brain Phantom Construction on Mimicry of the True Brain Model

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In the field of neuroscience, rat brain models are crucial for research and experimental testing. One of the leading solutions for animal and human experimentation is using phantoms: functionally accurate replicas of live tissue. The purpose of this investigation was to determine the effects of rat brain phantom construction on its ability to mimic the real tissue during brain stimulation. A tissue-separated model was developed and hypothesized to yield a magnetic flux density closest to the true brain. After skull-stripping a rat brain MRI, one construction was segmented into grey and white matter while another remained as one whole brain. A spherical model was created as a control for comparison with the other constructions. Each construction was stimulated using a transcranial magnetic stimulation procedure in ANSYS Maxwell. The tissue-segmented model had the closest magnetic flux density (0.6036 T) to the real brain (0.6 T) followed by the whole brain and then spherical constructions. The observed results supported the hypothesis that the tissue-segmented model would most closely mimic the true rat brain. Multiple t-tests showed that each comparison was statistically significant; therefore, phantom construction does have an effect on the mimicry of the true brain. The findings from this experiment resemble other studies that found similar patterns in the stimulated region. The tissue-segmented model most closely mimicked the true brain likely from the combination of accurate geometric and dielectric properties. To improve the phantom, further research into creating a physical model and adapting results to human models is needed.