

Designing an EEG Phantom to Represent Neurological Injury

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Background Information

Patients who have suffered from a stroke or cerebral palsy display significant lesions affecting how electrical activity is dispersed throughout the brain.

Brain-Computer Interface (BCI) headsets have significant potential to assist patients in completing motor tasks.



Where do we put electrodes in the presence of lesioned tissue to maximize electrical response?

Purpose Behind Phantoms

A three-dimensional model to mimic real-life anatomical, conductive, dielectric properties.

Our objective was to develop a baseline truth representing EEG for pediatric patients with early-life brain injury by building a real-world phantom model based on participant-specific MRIs.

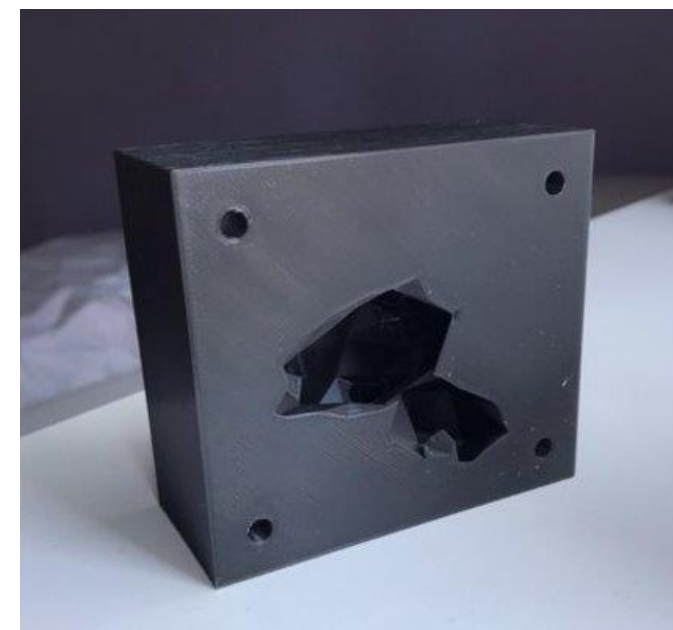


Fig.1 Sagittal-Cut Solidworks 3D-Printed Mold

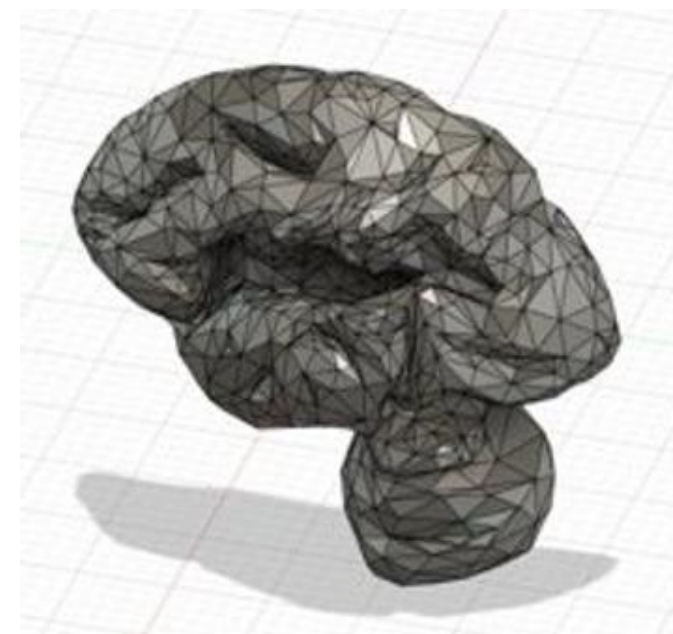


Fig.3 Autodesk Fusion 360 Reduced Faces Grey Matter STL

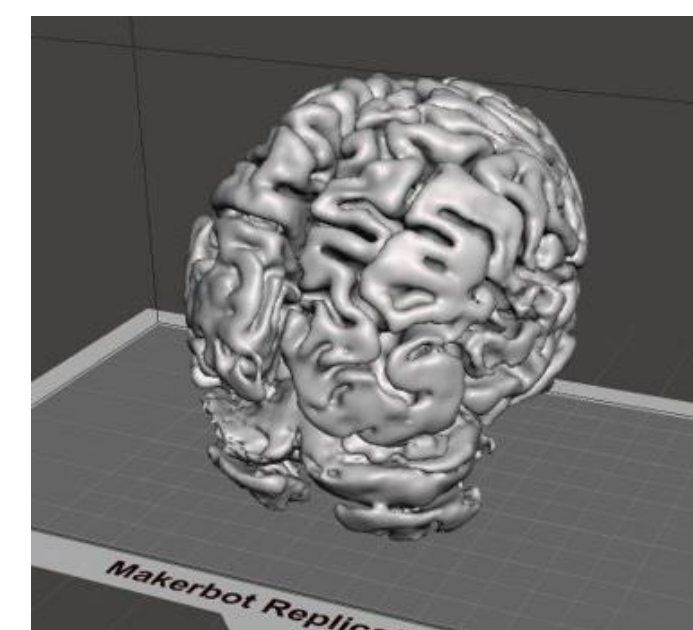


Fig.2 Autodesk Meshmixer Grey Matter STL

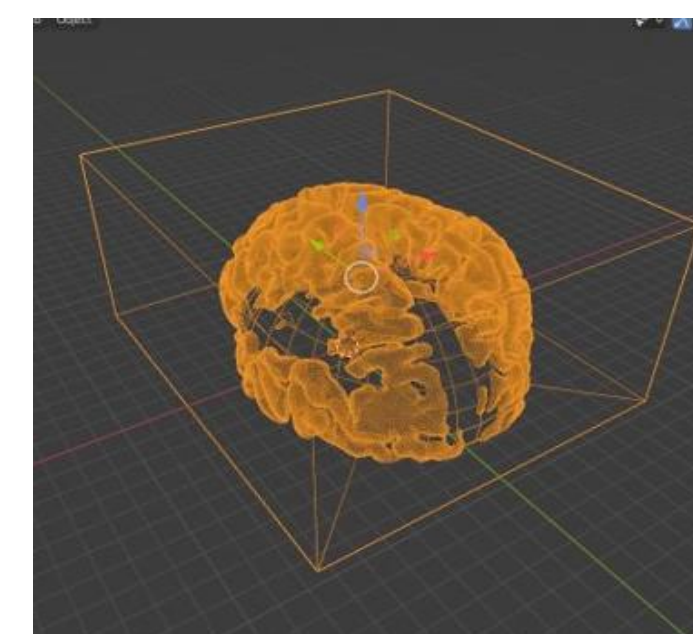


Fig.4 Blender Grey Matter Mold

Methods

- 1 Convert MRI files into STL
- 2 Create 3D mold imprint for 3 layers
- 3 Pour gel at specified conductivities
- 4 Assemble layers into structure

Results

Blender was determined to be the best software for creating molds

- Transversely cut for optimal extraction
- Utilization of Boolean difference tool
- Efficient and easy-to-understand software
- Maintained high precision for printability

Reached out to work with Exergy Solutions at UCalgary Life Science Innovation Hub

Future Directions

- Focusing on testing different gels and their conductivities using the following possible methods:
 - Manufactured silicone
 - Agarose soaking in electrolyte
 - Microbeads
- Assembly of white matter, grey matter, cerebral spinal fluid (CSF), and skull layers.
- Signal testing by sending square wave through phantom.