Intracranial EEG Phantom for Brain Stimulation Studies

Date: 10/09/2025

Client: Dr. Raheel Ahmed

Alternative Contact: Dr. Arun Karumattu Manattu

Advisor: Dr. Paul Campagnola

Team:

Avery Schuda *(Team Leader)*

Lilly Mackenzie *(Communicator)*

Helene Schroeder *(BSAC)*

Orla Ryan *(BWIG)*

Corissa Hutmaker *(BPAG)*

Problem statement

Intracranial electroencephalography (iEEG) is routinely used in surgical planning for individuals with uncontrolled seizures. Transcranial magnetic stimulation (TMS) may provide complementary information for mapping out critical brain regions that should be avoided during surgery, however, there are still safety concerns around the use of TMS in patients with iEEG. The major safety concerns are the induction of electrical currents, heating, and displacement of the implanted electrodes. The goal of this project is to develop a phantom that can be used to simulate the effect of TMS on electrode currents, temperatures, and changes in position.

Brief status update

Following the preliminary presentation, the team worked on the preliminary report. The team also began discussing purchasing hydrogel material and testing plans. We plan to test shear modulus and other mechanical properties with a rheometer, and conductivity vs. concentration of gel and saline with a design of experiments (DOE).

Difficulties / advice requests

Major team goals for the next week

1. Complete preliminary report
2. Order agar for hydrogel
3. Plan testing on the rheometer
4. Create conductivity testing plan

Next week's individual goals

- Avery
  - Finish the preliminary report with team
  - Plan a DOE to test hydrogel conductivity
- Lilly
  - Finish preliminary report and establish fabrication protocol
  - Begin oragnizing and ordering amterials
- Helene
  - Complete the preliminary report with the team
  - Begin creating protocols for fabricating the hydrogel
- Orla
  - Finish up preliminary report and proofread
  - Review hydrogel fabrication techniques
- Corissa
  - Finish writing the preliminary report and go over it with the team
  - Order hydrogel to begin fabrication and testing

Timeline

Task	Sept				Oct					Nov				Dec	
	5	12	19	26	3	10	17	24	31	7	14	21	28	5	10
Project R&D															
Empathize	X	X													
Background		X	X	X	X	X									
Prototyping						X									
Testings															
Deliverables															
Progress Reports		X	X	X	X	X									
PDS			X												
Prelim Presentation					X										
Final Poster															
Final Report/Notebook															
Meetings															
Client		X			X										

Advisor	X	X	X	X		X									
Website															
Update	X	X	X	X	X	X									

Filled boxes = projected timeline
X = task was worked on or completed

Previous week's goals and accomplishments

- Avery
  - 3D printed Formlabs BioMed clear material sample for presentation prop
  - Completed preliminary presentation with team
  - Created SolidWorks model of box gel phantom
- Lilly
  - Presented preliminary design to peers
  - Met with client to discuss project
- Helene
  - Completed preliminary presentation with the team
  - Researched hydrogels to understand how they are typically fabricated
- Orla
  - Picked up sample electrodes for preliminary presentation
  - Conducted more research on epilepsy surgical techniques
- Corissa
  - Delivered preliminary presentation and started preliminary report
  - Continued research on hydrogels and TMS testing protocols

Current design

N/A

Materials and expenses

Item	Description	Manufac-turer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
3D prints										
Formlabs BioMed Clear Sample Swatch	Step wedge with thicknesses of 0.1, 0.2, and 0.3 inches for prelim presentation prop	UW Design and Innovation Lab	N/A	N/A	N/A	10/1	1	$7.14	$7.14	
									$0.00	

Category 2										
									$0.00	
									$0.00	
								TOTAL:	**$0.00**	