Intracranial EEG Phantom for Brain Stimulation Studies

Date: 11/13/2025

Client: Dr. Raheel Ahmed

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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

This week the team fabricated multiple sets of hydrogels and attempted to test them on the rheometer in the BME teaching lab. We are running into some issues with the rheometer software crashing and the machine not calibrating correctly, so we are still working on completing our baseline shear tests on the hydrogel. We also looked into crosslinking options for the hydrogel to improve its mechanical properties and created our first set of UV crosslinked hydrogels.

Difficulties / advice requests

We are struggling to obtain usable data from the rheometer in the BME teaching lab since the software keeps crashing during testing. We attempted to reach out to the soft material characterization lab for assistance but were informed they only provide fee for service based options.

Major team goals for the next week

1. Process CT scans into a workable CAD file
2. Fabricate gels and test on the rheometer
3. Create a temperature measurement system
4. Finalize outreach details

Next week's individual goals

- Avery
    - Process CT scans into CAD file
    - Continue to work on rheometer testing
- Lilly
    - Continue working on hydrogel composition
    - Work on processing CT scans
- Helene
    - Begin work on final report and poster presentation with the team
    - Work on creating a thermistor for temperature measurements
- Orla
    - Consult with team on accessing rheometer
    - Create final draft of outreach plan to share with Dr. TJP
    - Write draft of background for final report
- Corissa
    - Put together thermistor measurement system with functioning code
    - Gel swell testing with cross-linked vs non cross-linked
    - Iron out rheometer issues and/or look into using MTS instead

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	X	X	X	X					
Testings								X	X	X	X				
Deliverables															

Progress Reports		X	X	X	X	X	X	X	X	X	X				
PDS			X												
Prelim Presentation					X										
Final Poster															
Final Report/Notebook															
Meetings															
Client		X			X			X							
Advisor	X	X	X	X	X		X	X		X	X				
Website															
Update	X	X	X	X	X	X	X	X	X	X	X				

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

Previous week's goals and accomplishments

- Avery
  - Helped team fabricate new gels
  - Attempted testing on the rheometer
  - Downloaded software and prepared to process CT scans
- Lilly
  - Worked on gel composition and characterization experiments
  - Reached out to professors for help with testing/gel characterization
- Helene
  - Fabricated gels with the team to attempt to test them
  - Attempted to use rheometer with the team
- Orla
  - Completed draft of outreach plan
  - Worked on gel fabrication
  - Researched articles shared by Dr. Dean
- Corissa
  - Worked with team to try getting rheometer testing details
  - Fabricated cross-linked gels to test

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	
Hydrogel Materials										
Agar Powder, 500g	500g of agar powder for initial brain phantom fabrication	Thermo Fisher Scientific	A10752.36	Thermo Fisher Scientific	A10752.36	10/20	1	$128.65	$149.15	https://www.thermofisher.com/order/catalog/product/A10752.36
									$0.00	
								TOTAL:	**$156.29**	