

Knee Arthroscopy Manikin

Client: Corinne Henak

Consultants: Corinne Henak, Russ Johnson

Team: Shrey Ramesh (leader) Delaney Reindl (leader)
Jack Thurk (accountant) Connor Dokken (communicator)
Sierra Reschke (admin) Rachel Dallet (admin)

Status

Report Date: 02/01/24

Next Milestone: Individual Presentation

Deadline: 02/02/24

Status: on schedule (green), deadline at risk (yellow), deadline unachievable (red)

Technical Summary

As the second semester begins, the bone team, enclosure team and pump team have compiled a list of to-dos to ensure a final functional prototype. For the bone team, testing with live samples will be conducted. Although viable samples don't have to be used, it is of high priority that Dr. Henak is consulted for samples that she may not be using anymore. Following sample testing, the bones should be reprinted with additional bars going across the open section to allow for more structural support. The bone team will also need to find and buy magnets for the bone and enclosure. This semester, the enclosure team will need to find and order biocompatible caulk as well as materials for flexion of the joint. The entire enclosure with silicone wrapping will be assembled, and the tolerances will need to be adjusted and the fabrication methods for the upper enclosure will need to be reevaluated. Moreover, the pump team will need to fabricate the media reservoir with either acrylic or a leftover plastic to reduce printing cost. Research will need to be done on different ways to measure pressure. The second pump will need to be acquired, and then the full flow loop will need to be assembled. A higher fidelity bubbler will also need to be fabricated.

New Tasks

Bone Team

Task Name	Description and Concrete Outcome	Owner	Est. Time
Update BME and ME websites	Add the progress reports to both the ME and BME websites. Update the project status as well.	RD	0.5 hr

Look into TJA tissue protocol	Research into the protocol of how the total joint arthroplasty tissue is dealt with after removal	RD	2 hr
Research magnets for enclosure system	Find possible magnets to use for the enclosure system that don't break off during assembly	RD	2 hr
Schedule testing times for the TJA samples	Talk with Dr. Henak and Sierra and find times to begin testing on the TJA samples. Also collaborate with the rest of the group on when a working model will be ready.	RD	1.5 hr
Research magnets for bone and enclosure attachment.	Conduct research into possible magnets that can be used in place of the currently implemented magnets. The current magnets are brittle and pieces often fall off during use. Ensure the dimensions are compatible with the current design.	SGR	2 hr
Schedule TJA discarding testing times.	Work with Dr. Henak to schedule testing times and availability with the total joint arthroscopy discarded samples.	SGR	1 hr
Develop sample acquisition and testing plan	Work with Rachel and the rest of the team to begin to develop the plan for acquiring the TJA discard samples as well as the testing protocols.	SGR	2 hr
Assist other sub-teams	Assist the other sub-teams with any tasks or ideas that arise.	SGR	1 hr

Enclosure Team

Task Name	Description and Concrete Outcome	Owner	Est. Time
Biocompatible Caulk	I will need to research and order biocompatible caulk as a method of sealing the enclosure material to the frame. Another option would be superglue, however we want this to be biocompatible/medical grade so it does not conflict with viability testing. As of now, we may use super glue as a cheaper seal method.	DR	1 hr
Flexion of Joint Material	I will need to research materials that allow for flexion of the joint, while not impeding	DR	3 hr

	mechanical movement of the model or conflicting with viability testing. Last semester we ordered a silicone sheet, but it turns out to be too stiff to allow for the desired movement of the knee model.		
Flexion of Joint Material (cont.)	As an aside to the aforementioned material for joint flexion, I will research a different enclosure material altogether that may meet the flexibility demands of the knee model. Considering the use of a polyethylene material with hose clamps.	DR	2 hr
Update enclosure CAD	Update the enclosure CAD based on the preliminary feedback from Dr. Henak as well as visual inspection	SR	3 hr
Make preliminary changes to bone CAD	Add more crossbars to the top of the bone and wait for feedback from Sierra and Rachel for what other changes should be made	SR	3 hr

Pump Team

Task Name	Description and Concrete Outcome	Owner	Est. Time
Find reservoir materials	Look through available resources, specifically scrap acrylic or plastic, to find suitable materials for the reservoir. If needed consult advisors and Dr. Cheadle.	CD	1 hr
Begin assembling reservoir	Pick up materials and begin designing enclosures based on what is available. The fabrication methods used will depend on the material picked for the walls of the reservoir.	CD	3 hr
Research flow rate sensors	Research whether or not the acquired flow rate sensor is compatible with liquids, or if the company offers a similar product that is designed for use with liquids.	CD	2 hr
Create the second half of the tubing system	To complete the closed loop for fluid flow, the tubing from the enclosure to the reservoir needs to be made. The system will look very	JT	2 hr

	similar and will require another pump system which Shrey is able to find and provide.		
Create a design matrix for the bubbler attachments.	From last semester, there were two different bubbler attachments being considered. These bubblers will be responsible for distributing Nitrogen gas through the PBS liquid. Once a design matrix is created, a clear winner between the two designs will be seen and therefore chosen for the final prototype.	JT	2 hr
Based on the design matrix, find a more permanent solution for fabricating the bubbler attachments.	Once a bubbler design is chosen, find better ways for the bubbler to be made so that there is less chance of equipment failure and need for replacement.	JT	1 hr
Look into pump tubing clamps for connection between tubing and enclosure	Research into pump clamps and find clamp options for eliminating potential leaks from the connection ports between the enclosure and the pump tubing. These clamps could possibly be used to replace caulk that was previously being considered.	JT	1 hr

Old Tasks

Nothing to report.

Bone Team

Enclosure Team

Pump Team

Technical Section

Nothing to report.

Miscellaneous

Proof of Concept											O				
Design				X	X	X	X								
Fabrication							X	X	X						
Presentation and Demonstration										X					
Midyear Review															O
Physical Prototype								X	X	X	X	X			
Report												X			
Presentation												X	X		

X = Completed Tasks, O = Milestone Deadlines