

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: 02/22/2024

Next Milestone: Working Prototype

Deadline: 02/23/2024

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

Technical Summary

Important aspects of this past week include meeting with Dr. Henak and Dr. Johnson to discuss weekly updates as well as to receive feedback on the progress of each project division. Within this past week, the bone team researched new wires and magnets to order for the attachment mechanism, as the previous wire was too stiff and the previous magnet was not strong enough. The enclosure team put in an order for the stainless steel duct clamps, and determined which polyethylene bags to order for the enclosure material. The bone and enclosure CAD were also updated and a flow rate sensor was ordered. The pump team reevaluated the bubbler attachments and brainstormed how the dissolved oxygen sensor will be used with the reservoir during testing. The reservoir box began fabrication and medical tubing suction cup holders were ordered to help reduce the potential for media leakage during testing. Each team member also gave their individual presentations as well.

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

Give individual presentation	Present to peers and TAs on Wednesday at 4pm. Go through my contributions to the project.	RD	.5 hr
Perform stress analysis on the enclosure system	Load the CAD into FEBio and perform a stress analysis on it given modulus of elasticity and young's modulus.	RD	3 hr
Order new wire	Talk to Jack and Dr. Henak about our budget. Then either order or obtain new wire from the makerspace. Determine if it's bendable.	RD	2 hr
Implement attachment mechanism changes	Continue working to update the wire, bone models, and sample attachment mechanism based on the main takeaways from testing.	SGR	2 hr
Stress analysis of enclosure	Utilize FEBio to perform a stress analysis on the enclosure FE model and analyze the results.	SGR	2.5 hr
Experiment with and order new wire	Experiment with different wires of different thicknesses to replace the current wire in our attachment mechanism as it is too stiff.	SGR	1 hr
Attend individual presentation.	Present my individual presentation on Wednesday, February 21st and review the presentations of my peers.	SGR	0.5 hr

Enclosure Team

Task Name	Description and Concrete Outcome	Owner	Est. Time
Order PE film bags	Determine necessary dimensions for the press-to-close bags and place an order through Josh.	DR	0.5 hr
Attend Individual Presentation	Give presentation of individual contributions (Feb 21) thus far and peer review three other groups.	DR	0.75 hr
Research other biocompatible caulk options	Determine if the biocompatible caulk is for sure the material we want to go forward with and find other options and submit the order form through Josh.	DR	1.25 hr
Develop enclosure attachment plan	Draw out a material enclosure plan to highlight where each material will go.	DR	2.5 hr

Order flow rate sensor for Pump team	Request a free sample of the fluid flow rate sensor from Renesas	SKR	.5 hr
Reprint Enclosure	Redesign and reprint enclosure based on third iteration of testing	SKR	3 hr
Print Updated Bones	Go to the Makerspace and print the updated tibia and femur models	SKR	1 hr
Assemble Full Enclosure	Using previous enclosure prints and silicone, assemble a full enclosure to test resistance to leaks	SKR	2 hr

Pump Team

Task Name	Description and Concrete Outcome	Owner	Est. Time
Fabricate the reservoir box	The plastic was cut but the bonding agent is still being delivered. Once delivered, the bonding agent will be applied to create the box and test it for potential leaks and durability. UPDATE: The bonding agent still has not arrived yet	JT	3 hr
Order various materials needed for project	This week, a lot of time was spent waiting to see if there was indeed a funding string that we would be able to use to order from external vendors. Now that that is cleared up, I will place various orders for things needed for our project such as clamps for the enclosure team.	JT	1.5 hr
Create second half of medical tube and pump setup (from the outlet of the enclosure to the inlet of the reservoir)	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 similar and will require another pump system which Shrey is able to find and provide.	JT	1.5
Finish fabricating reservoir	Still waiting for bonding agent to be shipped, progress was checked with our TA today. Once arrived the reservoir will be assembled. Need to fabricate piece to hold dissolved oxygen sensor as well.	CD	3 hr

Re-evaluate/design bubbler attachments	Decide on a final bubbler attachment and create final prototype, or order selected bubbler stone	CD	2 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	1 hr

Old 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
Find new wire to order	Go to the makerspace and experiment with different wires to find a more bendable wire to order	RD	2 hr
Decide on new magnets to order	After talking with the group, the original magnets I found aren't ideal. We might need to look into strength testing of the magnets and order different ones.	RD	2 hr
Begin working on my individual presentation	Start making slides for next week's individual presentation. Ask Josh logistical questions at our upcoming meeting.	RD	1.5 hr
Implement attachment mechanism changes	Update the wire, bone models, and sample attachment mechanism based on the main takeaways from testing last week.	SGR	2 hr
Complete individual presentation.	Begin and finish making slides for my individual presentation next Monday. Practice my presentation and ensure it is under 5 minutes.	SGR	2 hr

Assist with finalizing the ordering of magnets	Assist Rachel with researching better magnets and with the ordering if we find suitable ones. Begin to implement them into the bone model design if/when they arrive.	SGR	2 hr
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Enclosure Team

Task Name	Description and Concrete Outcome	Owner	Est. Time
Order biocompatible caulk, PE film	Place order for PE film. Research went into new biocompatible caulk to purchase as the previous option is not purchasable for personal use.	DR	2.5 hr
Determine enclosure material attachment plan	Develop an exact enclosure material attachment plan. This will involve determining which region of the enclosure frame will need which specific material. It may be helpful to devise back up plans as well.	DR	2.5 hr
Find and order hose clamps	Need to research various types of "hose" clamps that will function to help keep the PE film attached onto the frame.	DR	1 hr
Update Bone CAD	Update the bone CAD based on feedback from Rachel and Sierra's testing. Some of the changes to be made include adding more points of attachment and adding a "lip" below the mounting edges of the model.	SKR	4 hr
Order flow rate sensor for Pump team	Request a free sample of the fluid flow rate sensor from Renesas	SKR	.5 hr
Prepare and deliver individual presentation	Prepare slides summarizing individual contributions to the project and deliver it to other ME 352 students and TAs	SKR	1.5 hr

Pump Team

Task Name	Description and Concrete Outcome	Owner	Est. Time
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Re-evaluate/design bubbler attachments	Decide on a final bubbler attachment and create final prototype, or order selected bubbler stone	CD	2 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	1 hr
Begin work on individual presentations	Start reviewing requirements and making slides for individual presentations next week	CD	2 hr
Dissolved oxygen sensor placement	Brainstorm how the dissolved oxygen sensor will be used with the design of the reservoir during testing	CD	1 hr
Work on individual presentations	For the individual presentations on Monday at 4:30 the slides will need to be created and practiced this weekend in preparation.	JT	2 hr
Order medical tubing suction cup holders	To reduce permanent features and therefore possible leaks in the reservoir, suction cup holders that would clip on to the tubing and suction to the inside of the reservoir will be used. This would minimize potential leaks or errors when drilling holes into the side of the reservoir	JT	1 hr
Fabricate the reservoir box	The plastic was cut but the bonding agent is still being delivered. Once delivered, the bonding agent will be applied to create the box and test it for potential leaks and durability.	JT	3 hr

Technical Section

Decide on new magnets to order	After talking with the group, the original magnets I found aren't ideal. We might need to look into strength testing of the magnets and order different ones.	RD	2 hr
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Author: Rachel Dallet

Instead of ordering magnets from a huge pack online, we found cheap ones from the makerspace. I believe they are about 11 cents a piece and are pretty strong. We will need to find a quantitative way of measuring their strength but they seem like they will do the job.

Begin working on my individual presentation	Start making slides for next week's individual presentation. Ask Josh logistical questions at our upcoming meeting.	RD	1.5 hr
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Author: Rachel Dallet

Here is a link to my individual presentation slides:

https://docs.google.com/presentation/d/1JT_McG6uLQhN-RokoMBdX1rxkUCnotbSljMh2Bu29io/edit#slide=id.g24b1429f884_0_0

I finalized my slides and practiced running through them. I then gave my presentation and peer evaluated other individuals.

Author: Sierra Reschke

Complete individual presentation.	Begin and finish making slides for my individual presentation next Monday. Practice my presentation and ensure it is under 5 minutes.	SGR	2 hr
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I completed the slides for my individual presentation. I have been practicing to ensure it is under the 5 minute time limit and will be giving this presentation on Wednesday, February 21st. I will also attend, listen to, and review the presentations of my peers from other groups.

Assist with finalizing the ordering of magnets	Assist Rachel with researching better magnets and with the ordering if we find suitable ones. Begin to implement them into the bone model design if/when they arrive.	SGR	2 hr
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The magnets were ordered and have arrived. The bone team and enclosure team are working to integrate these magnets into the prototype along with the other changes that resulted from the initial attachment mechanism testing.

Work on individual presentations	For the individual presentations on Monday at 4:30 the slides will need to be created and practiced this weekend in preparation.	JT	2 hr
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I completed and practiced my slides before presenting them to fellow peers and TA's. The presentation went smoothly and I was able to finish my presentation at right around the 5 minute mark.

Begin work on individual presentations	Start reviewing requirements and making slides for individual presentations next week	CD	2 hr
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I completed my individual presentation and the associated peer reviews. The presentation went well and all criteria were met for the presentation. Still awaiting feedback.

Dissolved oxygen sensor placement	Brainstorm how the dissolved oxygen sensor will be used with the design of the reservoir during testing	CD	1 hr
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We decided we will use an extra ~3" x 6" piece of acrylic with a 1.5" hole cutout in the center to hold the probe for the dissolved oxygen sensor. This piece will sit on top of the reservoir which will sit on the top of the reservoir and hold the dissolved oxygen sensor in the media throughout the duration of the test.

Update Bone CAD	Update the bone CAD based on feedback from Rachel and Sierra's testing. Some of the changes to be made include adding more points of attachment and adding a "lip" below the mounting edges of the model.	SKR	4 hr
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The bone CAD was updated to remove the current crossbar and add a greater number of bars below the upper surface of the bone to create a "lip" for smaller tissue samples to remain secure

for the duration of testing. Additional attachment points were also included on the model as shown in the CAD model of the tibia below.



Prepare and deliver individual presentation	Prepare slides summarizing individual contributions to the project and deliver it to other ME 352 students and TAs	SKR	1.5 hr
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I delivered my individual presentation and delivered feedback to three other peers and two TA's

Author: Delaney Reindl

Find and order hose clamps	Need to research various types of "hose" clamps that will function to help keep the PE film attached onto the frame.	DR	1 hr
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A four-piece set of 6" 304 stainless steel duct clamps were ordered which will function to secure the material enclosure on the outer diameter of the enclosure frame. We ordered 6" because the other diameter is ~5.6" and a clamp will be applied on each end. A four-piece set of 5" clamps were also purchased to secure the material on the "inner diameter" of the frame, which is ~4.85"; two clamps will be applied on each end.

Gantt Chart

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Feb				Mar					Apr			May		
Task	2	9	16	23	1	8	15	22	29	5	12	19	26	3	10
Individual Presentations				O											
Testing	X														
Redesign and Fabrication	X	X	X	X											
Presentations				X											
Working Prototype Demonstration									O						
Redesign															
Fabrication															
Presentation and Demonstration															
Final Presentation															
Testing															
Report															
Presentation															

X = Completed Tasks, O = Milestone Deadlines