

Veterinary bone marrow aspirate models

Date: 11/21/2024

Client: Dr. McLean Gunderson

Advisor: Prof. Randy Bartels

Team:

- Avery Schuda - Co-Leader - aschuda@wisc.edu
- Helene Schroeder - Co-Leader, BSAC - hschroeder4@wisc.edu
- Anya Bergman - Communicator - ambergman2@wisc.edu
- Ella Cain - BWIG - elcain2@wisc.edu
- Ellie Kothbauer - BPAG - ekothbauer@wisc.edu

Problem Statement

Veterinary professionals commonly collect bone marrow aspirates from three main sites in dogs and cats: the iliac crest, the trochanteric fossa, and, mostly commonly, the proximal humerus. Currently no veterinary bone aspiration models exist for students to practice on, requiring the use of cadaver dogs. Cadavers can only be used for about 5-10 insertions of the Illinois bone marrow biopsy needle per site, but does not contain live bone marrow that can be collected. This project aims to create a low-cost 3D anatomically correct model of the humerus with relevant soft tissue structures, mimics the consistency and structure of the bones, and allows for insertion of "bone marrow" for collection, allowing veterinary students to practice the skill of bone marrow aspiration.

Brief Status Update

This week the team has been hard at work on fabrication. We have been working through the kinks with the CAD models and 3D printing several iterations of the design. The team met to finalize the last aspects of the design, work on fabrication, and begin work on final deliverables.

Difficulties / advice requests

The team hopes to meet with Dr. Gunderson and her team to obtain some quantitative testing data and discuss the final design ahead of the poster session.

Prelim Report						X									
Final Poster															
Final Report/Notebook															
Meetings															
Client		X		X											
Advisor	X	X	X			X				X		X			
Website															
Update	X	X	X	X	X	X	X	X	X	X	X	X			

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

Current design

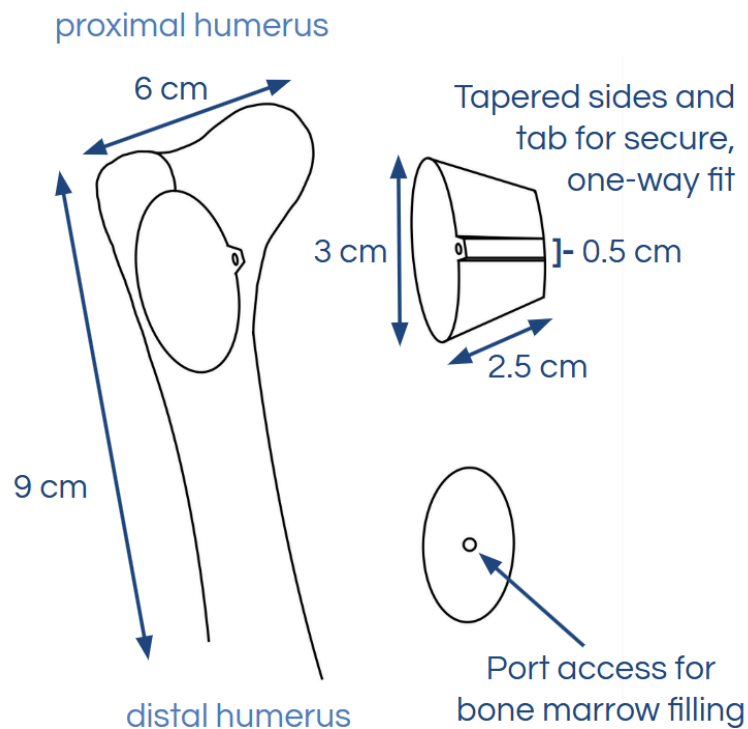


Figure 1: Drawing of the Slide Method of attachment

The proposed final design features the Slide Method of attachment for the design of the replaceable component. The oval section will be hollow to allow the client to fill the simulated bone marrow fluid into the port in the base of the design. The tab allows the user to easily orient the removable section correctly and slide it into place. Both the replaceable component and the rest of the bony structures (scapula, humerus, and fixed elbow) will be 3D printed using PLA. Surrounding the bones will be relevant musculature made from soft silicone which will further help the replaceable component remain in place when the needle enters and exits. The

simulated skin, fabricated by the client out of neoprene and pourable silicone, will be affixed over top and will help to hold the musculature and bones in an anatomical position.

Previous week's goals and accomplishments

- Team
 - Ordered remaining materials for testing and fabrication.
 - Continued work on the CAD models.
 - 3D printed further iterations of the bones for testing.
 - Finish fabrication before leaving for Thanksgiving break.
 - Finalized testing plans.
 - Began working on final deliverables.
- Avery
 - Brainstormed methods to obtain quantitative testing data.
 - Continued to work on CAD model and fabrication.
 - Made plans for assembly and documentation.
- Helene
 - Continued the fabrication process with the team.
 - Planned the final schedule for making the final report and presentation.
 - Fabricated the base for the model.
- Anya
 - Worked on CAD model and finalize design.
 - Worked on fabrication and methods for assembly.
 - Worked on getting quantitative testing.
- Ella
 - Helped with the printing of the bone models.
 - Fabricated the base for the model.
 - Found an adhesive for the pseudo-skin and muscle.
- Ellie
 - Helped work with the model bones and figure out ways to carve out the portion
 - Brainstormed ways to attach the silicone, and make it look muscle-like
 - Procured skin and met with team to fabricate

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)

Avery Schuda	11/21/24	-Met with Ella to finalize base design. -Worked on CAD models. -Met with team to work on fabrication. -Updated group aspects of design notebook.	14	14	71
Ellie Kothbauer	11/21/24	-Met with group to work on model - procured the skin -Met with team to fabricate	3	3	45
Anya Bergman	11/21/24	-3D printed newest edited CAD models -met with group to work on fabrication Began working on CAD connection between the joint and the humerus	5	5	43
Helene Schroeder	11/21/24	- Created documents for the poster presentation and the final report for the team to work on. - Met with the team to fabricate.	5	5	40
Ella Cain	11/21/24	-Met with Avery to discuss the model's base. -Met with the group to discuss fabrication and plans -Ordered materials and met with Anya to 3-D print humerus -Worked on the model's base.	6	6	48

Materials and expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	QTY	Cost Each	Total	Link
Category 1										
Material test strips	We printed out strips of PLA, ABS, and PETG at different densities	Makerspace 3d printers		UW madison Makers		9/26/2024	3	\$0.17	\$0.51	

	to see with materials work the as a bone replication			pace						
Right Humerus PLA print	We printed out a Right Humerus out of Bambu Labs PLA Matte		7747593925	Makerspace Design Building		10/31/2024	1	\$1.38	\$1.38	
Right Leg Full Print	We printed out forelimb, humerus and Scapula	Makerspace		Makerspace Design Building		11/14	1	\$4.18	\$4.18	
4 Red silicone rubber sheets	4 1ft by 1ft sheets of Red silicone sheets were ordered for muscle replica	Tlence Store		Amazon		11/7/2024	1	\$23.99	\$23.99	
Universal joint (for shoulder joint)	1 3/8 in long, overall large, chrome	Westword	54PR13	Grainger		11/5/2024	1	\$17.08	\$17.08	
Alecpea Special Glue	Glue specifically for silicone	Alecpea		Amazon		11/18/2024	1	\$9.99	\$9.99	
Masonite	1/4 thick, 12 in x 36 in	Makerspace		Makerspace Design Building		11/20/2024	1	\$3.25	\$3.25	
Black Stainless Steel L-brackets	10 x 0.79", 10 x 1.57", 60 x screw	YAMASO		Amazon		11/18/2024	1	\$0.30	\$0.30	
Picture frame turn button fasteners	Package of 100 to fasten replaceable component to humerus	Hoedia		Amazon		11/18/2024	1	\$0.07	\$0.07	
Magnets	50 6 x 2 mm	Nuiknow		Amazon		11/18	1	\$0.08	\$0.08	

	magnets			n	/2024			9
Door Panel Clip	8 pack, clear acrylic	Prime-Line	T 8733	Amazon	11/18/2024	1	\$1.25	\$9.99
Non slip rubber feet	16 pcs with stainless steel wash screws, 2 sizes	Quadafy		Amazon	11/18/2024	1	\$0.37	\$5.89
							TOTAL:	\$25.88