

Veterinary bone marrow aspirate models

Date: 11/28/2024-12/5/2024

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

The team had a productive two weeks, meeting several times to finalize fabrication of the model, test, and complete the poster ahead of the poster session on Friday. We updated the design of the scapula and humerus connections to accommodate the ball and socket instead of the U-joint to achieve rotation of the shoulder. The design of the replaceable component was also updated to add a tab to provide a one-way fit, and increase the thickness of the aspiration site as suggested by the instructors during testing.

Difficulties / advice requests

We will need to send the final CAD/3D printing files to Dr. Gunderson, currently we are planning to use Dropbox, but let us know if there is another file sharing method that works better for you.

Previous two weeks' 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
 - Continued working on design deliverables.
 - Continued to work on CAD model and fabrication.
 - Worked on assembly, documentation, and methods for testing data
 - Continued working on CAD models based on team and client feedback.
 - Continued 3D printing final iterations of the design.
- Helene
 - Continued working on fabrication of final deliverables.
 - Worked on the poster presentation and the final report.
 - Looked ahead to testing by working on testing protocols.
- Anya
 - Finished joint connection in CAD between scapula and humerus
 - Continued 3D printing models to find the best one
 - Worked on inside of the replaceable segment.
 - Worked on final deliverables.
- Ella
 - Helped with the assembly and fabrication of the final design.
 - Worked on the final design deliverables
 - Finalized fabrication of the model.
 - Completed poster segment
 - Brought materials to test for client
- Ellie
 - Helped with assembly and fabrication
 - Worked on final poster and other deliverables
 - Finalized fabrication of the model
 - Helped with testing of the model's components
 - Completed the poster to present on Friday

Activities (11/28 - 12/5)

| Name | Date | Activity | Time (h) | Week Total (h) | Sem. Total (h) |
|------------------|--------------------|---|----------|----------------|----------------|
| Avery Schuda | 11/28/24 - 12/5/24 | -Worked on several final iterations of CAD models -3D printed final iterations of the model -Met with team to finish fabrication -Worked on and printed final poster -Worked on documentation and design deliverables | 35 | 35 | 106 |
| Ellie Kothbauer | 12/5/24 | -Met with the team and worked on the poster presentation -Met with the team to finish fabrication of the model -Started to work on deliverables | 10 | 10 | 55 |
| Anya Bergman | 12/5/24 | - 3D printed final components for the model. - Met with team to work on poster presentation and finish fabrication. - Started work on final deliverables. | 18 | 18 | 62 |
| Helene Schroeder | 12/5/24 | -3D printed final components for the model -Met with team to work on Presentation, and finish fabrication. -Worked on editing the poster and the final report. | 10 | 0 | 62 |
| Ella Cain | 12/5/24 | -Printed components for testing and fabrication at the Makerspace Met with team on Monday, Wednesday, and Thursday to finalize fabrication and complete the poster -Went with Anya to the School of Veterinary Medicine to present testing components to client and staff | 12 | 12 | 60 |

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 to see with materials work the as a bone replication | Makerspace 3d printers | | UW Madison Makerspace | | 9/26/2024 | 3 | \$0.17 | \$0.51 | |
| 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 | Glue specifically for | Alecpea | | Amazon | | 11/18 | 1 | \$9.99 | \$9.99 | |

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|-------------------------------------|---|------------|--------|----------------------------|--|------------|---|---------------|----------------|--|
| Special Glue | silicone | | | n | | /2024 | | | | |
| Masonite | ¼ 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 | \$5.99 | |
| Picture frame turn button fasteners | Package of 100 to fasten replaceable component to humerus | Hoedia | | Amazon | | 11/18/2024 | 1 | \$0.07 | \$6.98 | |
| Magnets | 50 6 x 2 mm magnets | Nuiknow | | Amazon | | 11/18/2024 | 1 | \$0.08 | \$3.99 | |
| 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 | |