Paracervical Block Training Model (PBTM), BME 200/300

Date: 10/30/2025

Client: Dr. Jessica Dalby
Advisor: Professor Randolph Ashton
Team:
Renee Sobania (Co-Team Leader)
Evelyn Ojard (Co-Team Leader)
Ellinore Letts (Communicator)
Abigayle Chapman (BSAC)
Nora Lorentz (BWIG)
Cadence Seymour (BPAG)

Problem Statement

A paracervical block (PCB) is a medical procedure which consists of injecting the tissue where the vaginal wall meets the outer part of the cervix, the cervicovaginal junction, with lidocaine in four locations; 2, 4, 8, and 10 o'clock. This procedure is done to reduce pain during intrauterine device (IUD) insertion and other gynecological procedures. Many women have to endure the procedure without the help of a PCB, or only have access to other less effective methods because of limited provider training and lack of realistic affordable models to practice on. Current task trainers that are used to practice IUD insertions typically do not have a cervicovaginal junction, which is making these models less realistic as you are unable to practice a paracervical block. This results in fewer providers learning proper PCB technique and thus more patients who are unable to have access to this procedure.

Our team is tasked with creating a realistic, reproducible, and low cost model that includes a realistic cervicovaginal junction to simulate PCB injections to train healthcare professionals to make this procedure more accessible. Creating an anatomically accurate model with materials that better simulate the mechanical properties of the female reproductive tissues by having a needle insertion resistance of 1.09N, and elasticity of 1.94 kPa/mm. This will allow providers to practice needle placement, injection, and IUD insertion in a supervised safe learning environment. Ultimately, our goal is to improve provider access to learning the PCB procedure and expand patient access to pain management in women's healthcare.

Brief Status Update

During week 8 of our design project, the team worked on preparing for MTS testing on the Ecoflex 00-20. We created two SolidWorks models for testing, one in the shape of a dogbone for tensile testing and one in a cylinder shape for compression testing. The dogbone and cylinder molds were printed in the Makerspace.

Weekly/Ongoing Difficulties

The team has no current concerns with completing the background research for the project. However, there are logistical project questions that will need to be addressed in upcoming client meetings and team meetings.

Summary of Weekly Team Member Design Accomplishments

- Team
    - The team continued working on designing Solidworks models for the Uterus and vaginal opening.
    - The team designed and printed a dogbone solidworks mold for the MTS tensile testing.
    - The team designed and printed a cylinder solidworks mold for MTS compression testing,
    - The team researched and prepared for MTS testing.
- Renee Sobania
    - Worked on creating the dogbone Solid Works design for MTS testing to teach to the rest of the group.
    - Helped the Sophomores learn solidworks and build a dogbone mold.
    - Printed the vaginal opening mold and dogbone mold in the makerspace.
- Evelyn Ojard
    - Worked on creating the dogbone SolidWorks mold to be able to begin MTS testing
    - Helped teach and guide the sophomores through creating a SolidWorks part (the dogbone mold)
    - Helped print the vaginal opening mold and dogbone mold in the makerspace
- Ellinore Letts
    - Completed MTS protocol.
    - Designed compression and tension solidworks molds.
- Abigayle Chapman
    - Assisted with Solidworks Design creation of vaginal opening mold
    - Created a dog bone mold in Solidworks for testing
    - Thoroughly researched possible procedural complications for paracervical blocks
    - Researched location of blood vessels in regards to cervix and uterus for purpose of incorporating feedback for user error when model is injected at location of vessel
- Nora Lorentz
    - Worked through SolidWorks tutorial to gain experience
    - Was able to use SolidWorks to create a dog bone mold that can be used for testing
- Cadence Seymour
    - This week I worked with the 300s to get a better understanding of how to use solid works
    - I also made the mold we need for the MTS testing with the group

    - I did some designing how we might incorporate the cervix and uterus connection aspect into the design.
    - I also got certified on the lathe and mill

Upcoming Team and Individual Goals

- Team
    - Continue working on a mold for the vaginal opening and uterus mold insert.
    - Modify Cervical mold and connector plate in Solidworks.
    - Begin MTS testing on Ecoflex if material arrives in time.
    - Form Ecoflex into Dog bone shape for testing.
- Renee Sobania
    - Make Ecoflex into a dogbone shape for MTS testing.
    - Modify the cervical mold to improve the cervicovaginal junction based on client feedback.
    - Complete MTS Testing
    - Work on Uterus Solidworks design
- Evelyn Ojard
    - Cast the Ecoflex in the mold to begin MTS testing
    - Modify the cervix mold based on feedback from our client after our meeting this Friday
    - Complete MTS Testing
    - Research dimensions of uterus to better understand how to do the SolidWorks drawing
- Ellinore Letts
    - MTS test.
    - Generate material results to design further prototypes.
- Abigayle Chapman
    - Assist with Exoflex dog bone/cervical mold modification
    - Continue research on how our model could signal procedural errors to a user
- Nora Lorentz
    - Continue working with the team to print and cast more components of our design
    - Further MTS testing progress on the materials
    - Sketch additionally needed parts in SolidWorks or perform any needed modifications
- Cadence Seymour
    - I want to fabricate the rest of the cervix molds with my group once the materials come
    - I also want to work with my group to perform MTS testing on our ecoflex
    - I also want to do some research on how we might incorporate an aspect of the design to pull the uterus from the cervix.

Previous Weeks Team and Individual Goals

- Team
    - Continue working on a mold for the vaginal opening and uterus mold insert.
    - Modify Cervical mold and connector plate in Solidworks.

    - Begin MTS testing on Ecoflex if material arrives in time.
    - Form Ecoflex into Dog bone shape for testing.
- Renee Sobania
    - Finish testing protocol for Ecoflex mechanical testing.
    - Make Ecoflex into a dogbone shape for MTS testing.
    - Modify the cervical mold to improve the cervicovaginal junction.
    - Create a mold for the vaginal opening and uterus mold insert.
- Evelyn Ojard
    - Modify the cervical mold to improve stability and the cervicovaginal junction and then print.
    - Discuss with the group about how we want to manufacture the uterus and vaginal opening
- Ellinore Letts
    - Prepare molds for compression and tensile testing.
    - Complete MTS testing.
- Abigayle Chapman
    - Contribute to creating cervical mold and connector plate in Solidworks.
    - Discuss the manufacturing process of uterus and vaginal opening with the group.
- Nora Lorentz
    - Research MTS further
    - Continue fabrication
    - Look into alterations that need to be made to our model as we notice problems arise during fabrication
- Cadence Seymour
    - I want to work on fabrication with the team
    - Work with the team to come up with alternative solutions to the problems in our preliminary prototype.

Activities

Name	**Date**	**Activity**	**Time (h)**	**Week Total (h)**	**Sem. Total (h)**
Renee Sobania	10/28	Worked on Dogbone mold in Solidworks Worked on Vaginal Opening Solidworks Design Human Testing Training	3 hour	3	32

Evelyn Ojard	10/28 10/29	Worked on Dogbone mold in Solidworks Human Testing Training Taught SolidWorks to the Sophomores Research	3 hr	3	30.5
Ellinore Letts	10/28 10/29	MTS Model development. Team Meeting	4	4	29
Abigayle Chapman	10/28 10/29	Worked on Solidworks Vaginal Opening Design Research Created Solidworks Dogbone Mill and Lathe Training Chemical Safety and Biosafety	1.0 2.0 1.0 5.0 1.0-		33
Nora Lorentz	10/29	Mill and Lathe Training Chemical Safety and Biosafety Training SolidWorks	5 1 2	8	30.5
Cadence Seymour	10/29	Mill and Lathe Training Chemical Safety and Biosafety training Solid works Designing	5 1 1 1	8	31.0

Project Timeline

PROJECT TITLE	Paracervical Block Training Model	TEAM NAME	PCBTM Team
DATE UPDATED	9/18		

					PHASE 1 - Prototype			PHASE 2 - Testing										PHASE 3 - Final Design	
TASK TITLE	TASK OWNER	START DATE	DUE DATE	PERCENT OF TASK COMPLETE	9/7 - 9/13	9/14 - 9/20	9/21-9/27	9/28-10/4	10/5 - 10/11	10/12 - 10/18	10/19-10/25	10/26-11/1	11/2-11/8	11/9-11/15	11/16-11/22	11/23-11/26	Thanksgiving Break	12/1-12/6	12/7-12/12
Materials and Research																			
Conduct Initial Background Research	Everyone	9/7	9/17	100%															
Product Design Specifications	Everyone	9/10	9/18	100%															
Design Matrix Criteria and Design Ideas	Everyone	9/19	9/24	100%															
Fabrication																			
Design in SolidWorks	Everyone	9/19	9/26	100%															
Start Fabrication Process	Everyone	9/22	10/3	100%															
Complete First Iteration	Everyone	10/3	10/31	50%															
Preliminary Presentation	Everyone	9/28	10/3	100%															
Show-and-Tell	Everyone	10/27	10/31	0%															
Testing																			
Tensile Testing	Everyone	11/1	11/8	0%															
Compression Testing	Everyone	11/9	11/15	0%															
Data Collection and Revisions	Everyone	11/16	11/22	0%															
Client testing	Everyone	11/16	11/22	0%															
Final Product																			
Final Product Client Testing	Everyone	11/23	11/29	0%															
Final Data Collection	Everyone	11/23	11/29	0%															
Final Report Draft	Everyone	11/23	11/29	0%															
Final Team Meeting	Everyone	11/23	11/29	0%															
Deliver Final Product to Client	Everyone	11/23	11/29	0%															
Final Documents																			
Final Notebook	Everyone	11/30	12/5	0%															
Write final report	Everyone	11/30	12/5	0%															
Prepare poster	Everyone	11/30	12/5	0%															
Review all final documents	Everyone	11/30	12/5	0%															
Final Poster Session	Everyone	11/30	12/5	0%															
Final peer and self evaluation		11/30	12/12	0%															

Gantt Chart

Materials and Expenses

Item	Description	Manufac-turer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
Category 1										
3D Printed Prototype	Preliminary prototype of mold for cervix	Makerspace	PLA basic	N/A	N/A	10/16/2025	1	$8.39	$8.39	
3D Printed Prototype	Preliminary prototype of mold for the uterus and connecting ring	Makerspace	PLA basic	N/A	N/A	10/16/2025	1	$5.10	$5.10	
Category 2										
Tubing	Charlotte pipe coupling 1.5” x 2” PVC DWV Hub x	N/a	PVC00102060 0HD	Homedepot	472476	10/23/2025	10	$1.59	$15.90	https://www.homedepot.com/p/Charlotte-Pipe-1-1-2-in-x-2-in-PVC-DWV-Hub-x-Hub-Increaser-Reducer-

										Coupling-PVC001020600HD/203391373
Tubing	Hub increaser/reducer PVC pipe 1.5-inch diameter x 6-inch length	N/a	PVC07112060 0	Homedepot	193844	10/23/2025	1	$7.32	$7.32	https://www.homedepot.com/p/Charlotte-Pipe-1-1-2-in-x-10-ft-PVC-Schedule-40-DWV-Pipe-PVC07112060 0/100348474?MERCH=REC-_-pipsem-_-100581718-_-0-_-n/a-_-n/a-_-n/a-_-n/a-_-n/a
Ecoflex	Ecoflex 00-20	N/a	N/a	Smooth-On	N/a	10/23/2025	3	$32.43	$64.86	https://shop.smooth-on.com/ecoflex-00-20
Tubing	PVC DWV All Hub Sanitary Reducing Tee 2 x 2 x 1.5 inches	N/a	PVC02400645 0HD	Homedepot	74323400	10/23/2025	10	$6.28	$62.80	https://www.homedepot.com/p/Charlotte-Pipe-2-in-x-2-in-x-1-1-2-in-PVC-Sch-40-Tee-PVC024006450HD/203821695
Adhesive	Gorilla construction adhesive – 1 tube	N/a	801000300	Homedepot	1001378150 00	10/23/2025	1	$9.98	$9.98	https://www.homedepot.com/p/Gorilla-9-oz-Heavy-Duty-Construction-Adhesive-8010003/206063265
Adhesive	Hook and loop tape with adhesive	N/a	90277B	Homedepot	23953600	10/23/2025	1	$20.93	$20.93	https://www.homedepot.c

	- white, ¾ inch, approximately 5” per task trainer									om/p/VELCRO-15-ft-x-3-4-in-White-Sticky-Back-Tape-90277B/202261924?g_store=4909&source=shoppingads&locale=en-US