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

Date: 10/23/2025

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 7 of our design project, the team worked on creating the first iteration of the cervix. This was done by pouring the Ecoflex 00-20 into the printed cervical mold. The Ecoflex was left to cure at room temperature for 24 hours and then the mold was removed and evaluated. The cervical mold and connector plates will both need slight adjustments. The team also sent a list of finalized materials to the client to purchase.

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 poured the first iteration of the cervical component using Ecoflex 0020.
    - The team researched and prepared for MTS testing.
    - The team sent a list of materials for the client to purchase.
- Renee Sobania
    - Poured Ecoflex 00-20 into the cervical mold and let it cure for 24 hours before removing it from the mold.
    - Continued research on MTS testing.
    - Evaluated the changes that would need to be made to the cervix including adjusting the cervicovaginal junction.
- Evelyn Ojard
    - Poured Ecoflex 00-20 into the cervical mold and let it cure before removing
    - Discussed and brainstormed the changes that would need to be made to the cervix to make it more stable while remaining anatomically correct.
- Ellinore Letts
    - Finalized Protocol for MTS testing.
    - Researched material standards, ultimate strengths.
    - Ensured materials were ordered and shipped.
- Abigayle Chapman
    - Mixed a concentration of Ecoflex and thinner and poured Ecoflex 00-20 into the cervical mold.
    - Continued research on MTS testing and went to see the MTS products currently on campus.
- Nora Lorentz
    - Worked with team to place Ecoflex and thinner mixture into cervical mold
    - Continued researching MTS testing
- Cadence Seymour
    - Worked with the team to pour the ecoflex material into the mold, and form our prototype of the cervix.
    - Continued to research more testing methods.

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
    - 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.

Previous Weeks Team and Individual Goals

- Team
    - Complete final purchasing of materials including the base plate, Ecoflex and PVC piping.
    - Create a mold for the vaginal opening and uterus mold insert.
    - Begin filling and testing molds with Ecoflex for testing.
    - Begin MTS testing on Ecoflex if material arrives in time.
- Renee Sobania
    - Write a specific testing protocol for Ecoflex mechanical testing.
    - Practice using the MTS Machine to be prepared when the Ecoflex arrives.
    - Create a mold for the vaginal opening and uterus mold insert.
- Evelyn Ojard
    - Write a complete testing protocol for all components of the model
    - Cast the cervix using 3D printed mold

- Ellinore Letts
    - Create material testing protocols.
    - Work on vaginal canal mold.
- Abigayle Chapman
    - Assist with testing plan creation
    - Continue research for testing process as necessary
    - Assist with ecoflex mold creation
- Nora Lorentz
    - Work with teammates to begin creating design/prototype
    - Continue researching testing methods in order to contribute to testing protocol
- Cadence Seymour
    - I want to work with the team to keep prototyping
    - Order materials
    - Fill in the BPAG spreadsheet with new purchases
    - Learn more about our testing process.

Activities

Name	**Date**	**Activity**	**Time (h)**	**Week Total (h)**	**Sem. Total (h)**
Renee Sobania	10/23/2025	Pouring and removal of Ecoflex in mold Research	1 1	2	29
Evelyn Ojard	10/23/25	Pouring and removal of cast Research	1.5 1	2.5	27.5
Ellinore Letts	10/23/25	MTS Research	2	2	25
Abigayle Chapman	10/23/2025	Pouring of Ecoflex cervical mold Research	1 1.5		23
Nora Lorentz	10/23/25	Pouring Ecoflex/thinner into cervical mold MTS research	1.5	1.5	22.5
Cadence Seymour	10/23/2025	Pouring Ecoflex Testing Research	1	1	23.0

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										
									$0.00	
									$0.00	
								TOTAL:	**$13.49**	