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

Date: 10/16/2025

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 6 of our design project, the team worked on 3D printing the components we have so far, such as the cervix mold, uterus and connecting plate. The team also began research on MTS testing to ensure we know how to use the equipment when we are ready for testing with the Ecoflex. The team also compiled a list of materials for the client to purchase, including the Ecoflex 00-20, PVC piping, and the wooden base.

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.
    - The team began 3D printing the cervix and connector plate.
    - The team researched and prepared for MTS testing.
    - The team compiled materials for the client to purchase.
- Renee Sobania
    - Went to makerspace and printed the Cervical mold, uterus, and connector plate.
    - Performed MTS testing research to ensure I knew how to use the machine and knew all the formulas to make a stress strain curve and calculate the Young's Modulus.
    - Compiled a list of materials for the client.
- Evelyn Ojard
    - Went to the makerspace and with help from staff printed the cervical mold, uterus, and connector plate
    - Continued research into potential testing methods and refreshed knowledge of MTS Testing
    - Finalized materials list
- Ellinore Letts
    - Reviewed mechanics of materials concepts to refresh knowledge of tensile testing and mechanical testing methods,
    - Finalized materials list.
    - Organized meeting with client.
- Abigayle Chapman
    - Researched potential testing methods for the mechanical properties of our materials
    - Researched the MTS technique
- Nora Lorentz
    - Researched how we can test our final design of the task trainer
    - Researched MTS testing
- Cadence Seymour
    - Filled out the progress report and spreadsheet with our prototyping purchases
    - Research the MTS technique for our testing to come
    - Research more about how our process is going to work.

Upcoming 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.

Previous Weeks Team and Individual Goals

- Team
    - Discuss final design, materials, and purchasing details with our client.
    - Order all materials including pieces for the base and Ecoflex 00-20.
    - Finalize fabrication plan for cervix, uterus and vaginal opening.
    - Design and print all molds for cervix, uterus and vaginal opening.
- Renee Sobania
    - Complete CAD design for the Uterus and Cervix and print them off in the makerspace to ensure they will work properly and have correct dimensions.
    - Order all materials for the project including Piping, wooden base, and Ecoflex.
    - Begin a specific testing protocol for Ecoflex mechanical testing.
- Evelyn Ojard
    - Order all materials for the project including Piping, wooden base, and Ecoflex.
    - Assist with SolidWorks designs as needed and look into trying to 3D print at the maker space for a preliminary prototype
    - Start writing out fabrication protocol and formal testing protocol.

- Ellinore Letts
    - Order materials needed for prototype manufacturing.
    - Decide on base and support dimensions and fabrication plan.
    - Begin on material testing protocol.
- Abigayle Chapman
    - Continue research on potential limiting factors of our design and materials to consider
    - Finalize and order materials for design and fabrication process
    - Consider and explore material testing practices to ensure model achieves its purpose
- Nora Lorentz
    - Finalize and order the materials we will need for our design
    - Work with team to define the final details for our design and fabrication plans
    - Continue researching
- Cadence Seymour
    - Work on ordering materials with the team
    - Work on manufacturing the mold for our lab kit.
    - Continue researching materials to find the best fit for our team.

Activities

Name	**Date**	**Activity**	**Time (h)**	**Week Total (h)**	**Sem. Total (h)**
Renee Sobania	10/16	3D printing in Makerspace Research on MTS testing	0.5 1	1.5	27
Evelyn Ojard	10/16	3D printing in Makerspace Research on testing	0.5 1.0	1.5	25.0
Ellinore Letts		Research	2.0	2.0	20
Abigayle Chapman	10/16	Research for testing	2		20.5
Nora Lorentz	10/16	Researched testing	2	2	21
Cadence Seymour	10/16	Research for testing & tracking finances	2	2	22.0

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
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	50%															
Complete First Iteration	Everyone	10/3	10/31	25%															
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**	