

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

Date: 11/20/2025

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 10 of our design project, the team continued to make adjustments to our design. Our team was able to assemble a complete model and bring it to Dr. Dalby for review, and think about how we can adjust our design to create a more accurate model. Our team has decided to make minor adjustments to our cervical component, structure, and vaginal opening to make the model align better with our clients needs.

Weekly/Ongoing Difficulties

Our team has received some additional feedback from our client. Although this has not brought additional difficulties, our team is going to adjust our current design to better address the challenges in our model.

Summary of Weekly Team Member Design Accomplishments

- Team
 - Our team assembled our first complete model.
 - Brought the model to Dr. Dalby to receive feedback, and consider how our design can be adjusted to be more accurate and fit to our clients needs.
 - Made design adjustments to the model.
- Renee Sobania
 - Adjusted the vaginal mold to make it easier to open and have an opening.
 - Assembled a rough prototype to show to Dr. Dalby.
 - Met with Dr. Dalby to show her the new model and get feedback on improvements that could be made to make the model more accurate/realistic.
 - Did research into patenting our model.
- Evelyn Ojard
 - Brought the model to Dr. Dalby to receive feedback on first complete prototype.
 - Spent a significant amount of time reworking almost all solidworks drawings to complete 3D printing before Thanksgiving break.
 - Spent time taking measurements of current components to make changes.
- Ellinore Letts
 - Coordinated with Dr. P to schedule MTS compression testing.
 - Worked with team to assemble the model, brought the model to Dr. Dalby to receive preliminary feedback.
 - Disclosed project to WARF.
- Abigayle Chapman
 - Began work on final report
 - Met with team to discuss client feedback and necessary changes, as well as future plan
 - Assisted with first model assembly
- Nora Lorentz
 - Met with team to discuss changes and plan for upcoming weeks
 - 3D printed new parts that include client's requested alterations
- Cadence Seymour
 - Start working on the final report
 - Continue fabrication

Upcoming Team and Individual Goals

- Team
- Renee Sobania
 - Continue to adjust the components to better fit our clients needs.

- o Meet with WARF about a patent.
 - o Make a full working and complete model to show to Dr. Dalby.
 - o Finish MTS testing.
 - o Begin working on final report.
- Evelyn Ojard
 - o Complete MTS compression testing, analyze all of the material testing data using Matlab and other statistical software.
 - o Complete all SolidWorks drawings and print all components
 - o Meet with WARF
 - o Divide up final report and final project
- Ellinore Letts
 - o Complete MTS compression testing, analyze all of the material testing data.
 - o Begin working on the final report, schedule a meeting with WARF.
 - o Continue to work on design.
- Abigayle Chapman
 - o Finish MTS testing and take data into consideration
 - o Work on final report
 - o Continue fabrication
- Nora Lorentz
 - o Finish MTS testing on our materials and examine the resulting data
 - o Start working on the final report
 - o Continue fabrication
- Cadence Seymour
 - o Start working on the final report
 - o Continue fabrication

Previous Weeks Team and Individual Goals

- Team
 - o Show the model to the client to get feedback
- Renee Sobania
 - o Bring a finished model to the client for feedback so we can finish the 4 models.
 - o Print off a new cervical mold, fill it with Ecoflex and see how it performs.
 - o Assemble a full model.
 - o Finish mechanical testing on the Ecoflex for compression.
- Evelyn Ojard
 - o Bring a finished model to the client for feedback so we can finish the 4 models.
 - o Make SolidWorks drawing of new cervical mold
 - o Print mold and cast with Ecoflex to see how it performs
 - o Assemble first prototype and present to client.
 - o Finish compression testing of material.
- Ellinore Letts
 - o Analyze MTS results, determine desired material changes.
 - o Create a base and complete a full model.
- Abigayle Chapman

- o Continue working towards creating the full model for client feedback
- o Finish MTS testing, consider results
- Nora Lorentz
 - o Continue working on fabrication process
 - o Have 4 model finished soon to show client
- Cadence Seymour
 - o I want to fabricate the rest of the cervix molds with my group once the materials come
 - o I also want to work with my group to perform MTS testing on our ecoflex
 - o I also want to do some research on how we might incorporate an aspect of the design to pull the uterus from the cervix.

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Renee Sobania	11/19	Met with Dr. Dalby to show her our initial prototype	1.5		36.5
		Made edits to and printed vaginal opening.	1		
		Met with the team to go over goals for the next few weeks and plan a schedule for the next semester.	2		
Evelyn Ojard	11/18	Met with Dr. Dalby to get feedback on first prototype	1.5		38
	11/18	Made edits to current components and created drawings for new components	5		
	11/19	3D Printing of new components and help in the makerspace	1		
	11/19	Met with team to discuss game plan for the rest of the semester	2		
Ellinore Letts			4	4	38

Abigayle Chapman	11/19	Met with team to discuss upcoming weeks and changes to model	1	2	42
	11/20	Began work on final report	1		
Nora Lorentz	11/20	3D printed new parts	2	2	36.5
Cadence Seymour	11/19		1	1	35

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	11/23-11/29	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	100%																																				
Testing																																								
Tensile Testing	Everyone	11/1	11/8	100%																																				
Compression Testing	Everyone	11/9	11/15	0%																																				
Data Collection and Revisions	Everyone	11/16	11/22	33%																																				
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	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	QTY	Cost Each	Total	Link
Category 1										
3D Printed	Preliminary prototype of mold	Makerspace	PLA basic	N/A	N/A	10/16/2025	1	\$8.39	\$8.39	

Prototype	for cervix									
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	
3D Printed Dog Bone	MTS testing dog bone mold	Makerspace	PLA basic	N/A	N/A	10/30/2025	1	\$3.21	\$3.21	
3D printed Prototype	Prototype of Uterus (clear)	Makerspace	PLA basic	N/A	N/A	11/05/2025	1	\$20.27	\$20.27	
Wood Sheet	Plywood sheet 1/4 in 28x36	makerspace	N/A	N/A	N/A	11/04/2025	1	\$7.50	\$7.50	
3D printed prototype	Vaginal opening prototype mold	Makerspace	PLA basic	N/A	N/A	11/05/2025	1	\$1.92	\$1.92	
3D Printed Prototype	2nd cervix mold prototype	Makerspace	PLA Basic	N/A	N/A	11/07/2025	1	\$3.81	\$3.81	
3D Printed prototype	new connecting piece	makerspace	PLA basic	N/A	N/A	11/12/2025	1	\$0.94	\$0.94	
3D printed prototype	New cervix mold	Makerspace	PLA basic	N/A	N/A	11/12/2025	1	\$3.71	\$3.71	
								Category 1 Total:	\$54.85	
Category 2										

Tubing	Charlotte pipe coupling 1.5" x 2" PVC DWV Hub x	N/a	PVC001 020600 HD	Homed epot	472476	10/23/ 2025	10	\$1.59	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	PVC071 120600	Homed epot	193844	10/23/ 2025	1	\$7.32	2	https://www.homedepot.com/p/Charlotte-Pipe-1-1-2-in-x-10-ft-PVC-Schedule-40-DWV-Pipe-PVC071120600/10348474?MERCH=REC_-pipsement_-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	\$32.4 3	\$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	PVC024 006450 HD	Homed epot	743234 00	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-PVC-024006450HD/203821695
Adhesive	Gorilla construction adhesive – 1 tube	N/a	80100 0300	Homed epot	100137 815000	10/23/ 2025	1	\$9.98	\$9.9 8	https://www.homedepot.com/p/Gorilla-9-oz-Heavy-Duty-Construction-Adhesive-8010003/206063265

									https:// www.ho medepo t.com/p /VELCR O-15-ft- x-3-4-in- White-S ticky-Ba ck-Tape- 90277B/ 202261 924?g_s tore=49 09&sou rce=sho ppingad s&locale =en-US	
Adhesive	Hook and loop tape with adhesive - white, ¾ inch, approximately 5” per task trainer	N/a	90277B	Homed epot	239536 00	10/23/ 2025	1	\$20.9 3	\$20. 93	
								Catego ry 2 Total:	\$18 1.79	
								OVER ALL TOTAL:	\$29 1.49	