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

Date: 11/13/2025

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 9 of our design project, the team continued making improvements to the different components of the model. The cervix model was remade to include a vaginal wall and it was printed off and filled with Ecoflex. The connector piece was also redesigned to adjust the height of the pins to fit it to the model.

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 remade the cervical component to have vaginal walls.
    - The new cervical mold was filled with Ecoflex 00-20.
    - The team modified and printed the connector plate to fit the new cervical component.
    - The team began assembling a complete model with all components.
- Renee Sobania
    - Started working on assembling all the components to make a complete model.
- Evelyn Ojard
    - Reworked and redimensioned the new uterus mold to better fit within the pipe.
    - Went to the makerspace and 3D printed the new uterus mold and reworked the connecting piece.
    - Began assembly of complete model.
- Ellinore Letts
    - Analyzed MTS testing results to measure how accurate our material is.
    - Began assembly of complete model.
- Abigayle Chapman
    - Researched exoflex cleaning and maintenance
- Nora Lorentz
    - Researched Ecoflex behavior to learn more about how it should react to testing
- Cadence Seymour
    - Finished the design for the new cervix connecting piece
    - I worked with the team to begin assembly of the final prototype for our client.
    - Filled the new cervical mold

Upcoming Team and Individual Goals

- Team
    - Show the model to the client to get feedback
- Renee Sobania
    - Bring a finished model to the client for feedback.
    - Assemble a full model.
    - Finish mechanical testing on the Ecoflex for compression.
- Evelyn Ojard
    - Finish assembling at least one complete model
    - Bring the finished model to the client for feedback.
    - Create a survey for residents and clinicians to complete after they use our model.

- Ellinore Letts
    - Finish assembling the complete model.
    - Receive feedback from client, adjust as needed.
- Abigayle Chapman
    - Assist with assembly of full model
    - Finish MTS testing
- Nora Lorentz
    - Have client look at the models and receive feedback
    - Finish MTS testing and assembly
- Cadence Seymour
    - I want to finish MTS testing and compression testing with the team
    - I want to finish assembly of our complete kit for the client to test
    - Process testing data from our client.

Previous Weeks Team and Individual Goals

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

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Renee Sobania	11/13	Assemble Model	1	1	36.5
Evelyn Ojard	11/10	Filled new cervix mold	1.5	3.5	38
	11/12	3D printed 3rd iteration of cervix mold and 2nd iteration of the connecting piece	1		
	11/13	3D printed 3rd iteration of connecting piece	1		
Ellinore Letts	11/10	MTS	2	2	34
Abigayle Chapman	11/12	Researched Ecoflex maintenance and cleaning for client's knowledge	1	1	40
Nora Lorentz	11/13	Ecoflex research	1	1	35.5
Cadence Seymour	11/12	Finished the connecting piece design Drew out more mold ideas	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	11/23-11/26	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	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 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	
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 of Uterus (clear)	Makerspace	PLA basic	N/A	N/A	11/05/2025	1	$20.27	$20.27	

Prototype										
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 openeing 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	PVC001020600HD	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-PVC00102060 0HD/20339137 3

Tubing	Hub increaser/reducer PVC pipe 1.5-inch diameter x 6-inch length	N/a	PVC071120600	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-PVC071120600/100348474?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	PVC024006450HD	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-PVC

										024006450HD/203821695
Adhesive	Gorilla construction adhesive – 1 tube	N/a	801000300	Homedepot	100137815000	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 - white, ¾ inch, approximately 5” per task trainer	N/a	90277B	Homedepot	23953600	10/23/2025	1	$20.93	$20.93	https://www.homedepot.com/p/VELCRO-15-ft-x-3-4-in-White-Sticky-Back-Tape-90277B/202261924?g_store=4909&source=shoppingads&locale=en-US
								Category 2 Total:	**$181.79**	
								OVER	**$29**	

								ALL TOTAL:	**1.49**	