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

Date: 12/4/2025

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 12 of our design project, the team worked on finalizing our model and making improvements based on Dr. Dalby's feedback. Our team was able to assemble a final model for Dr. Dalby and other technicians to review. Material testing was completed, and data was analyzed. The team finished mechanical testing on the Ecoflex and worked on the final poster presentation.

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
    - The team met with the Dr. Dalby to show her new components including the new
    - Our team assembled our complete model and gave it to our client for feedback.
    - 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
    - Readjusted the vaginal opening to fit the new PVC pipe.
    - Showed Dr. Dalby our new designs with the modified cervix, and PVC pipe to receive feedback.
    - Assembled a new model with improvements and dropped it off for Dr. Dalby to review.
    - Worked on and practiced for the final poster presentation.
- Evelyn Ojard
    - Worked on trying to print new uterus with MakerSpace staff which still resulted in failure.
    - Met with Dr. Dalby to show our new designs with the modified cervix, and PVC pipe to receive feedback and discuss the end of our project
    - Assembled a new model with improvements (specifcally cutting down the PVC pipe and coloring the cervix pink) and dropped it off for Dr. Dalby to review and have other physicians give feedback.
- Ellinore Letts
    - Wrote MATLAB codes to analyze MTS data.
    - Completed MTS testing.
    - Completed final poster and began on final report.
- Abigayle Chapman
    - Finished compressive testing for material testing
    - Worked on final report
    - Poured latest iteration of cervical mold
    - Attempted printing of new uterus design
    - Worked on and practiced with group for final poster presentation
    - Researched Young's modulus to clarify MTS testing values and understand testing process
- Nora Lorentz
    - Worked with team to complete the compression section of our MTS testing
    - Met with team to discuss final poster and report
    - Cast for a new model
    - Practiced final poster presentation with the team

- Cadence Seymour
    - I went with team members to ECB to complete our MTS testing, and do the compression testing portion.
    - Completed my section of the final poster presentation
    - Met with the group to practice the complete poster presentation
    - Met with the group to cast our final product

Upcoming Team and Individual Goals

- Team
    - Create 10 working prototypes to give to our client by the end of the semester.
    - Finish final report.
- Renee Sobania
    - Create 10 working prototypes for our Dr. Dalby.
    - Meet with WARF about a patent.
    - Finish Final Report.
- Evelyn Ojard
    - Create 10 working prototypes for our client.
    - Meet with WARF about a patent
    - Finish Final Report
- Ellinore Letts
    - Complete poster presentation and final report.
    - Finish fabricating 10 complete designs.
- Abigayle Chapman
    - Finish final report.
    - Present final poster with team
    - Complete prototypes for client
- Nora Lorentz
    - Finish the final report
    - Present the final poster
    - Complete models' fabrication process
- Cadence Seymour
    - This next week I want to work with the team to finalize our 10 prototypes to give to the client
    - Complete my section of the final report

Previous Weeks Team and Individual Goals

- Team
    - Continue fabrication and working on the model.
- Renee Sobania
    - Continue to adjust the components to better fit our clients needs.
    - Meet with WARF about a patent.
    - Make a full working and complete model to show to Dr. Dalby.
    - Finish MTS testing.
    - Begin working on the final report.

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

Activities

Name	**Date**	**Activity**	**Time (h)**	**Week Total (h)**	**Sem. Total (h)**
Renee Sobania	11/19	Met with Dr. Dalby to show her our new prototype Made edits to and printed vaginal opening. Met with the team to go over goals final presentations and reports Worked on Final Poster Presentation and Final Report Casted components for the final prototype	2 1 2 1	4.5	41

		Fabrication/Assembly of final prototype 3D Printed components for final prototype	1 2		
Evelyn Ojard	11/19	Met with Dr. Dalby to show her our new prototype Made edits to and printed vaginal opening. Met with the team to go over goals final presentations and reports Worked on Final Poster Presentation and Final Report Casted components for the final prototype Fabrication/Assembly of final prototype 3D Printed components for final prototype	2 1 2 1 1 2	4.5	42.5
Ellinore Letts	11/30 12/01 12/02	Final report MATLAB coding Compression	6	6	45
Abigayle Chapman	11/22 11/24 11/24 12/2 12/3	Worked on final report Attempted printing of new uterus design Poured new cervix mold Finished MTS compressive testing Worked on poster/researched	2 1 .5 1 1	5.5	47.5
Nora Lorentz	11/30 12/2	Worked on final report MTS compression testing	2 1	6	42.5

	12/3 12/4	Worked on final poster Worked on/practiced the final poster poster alone. Practiced poster with team.	1 2		
Cadence Seymour					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
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	100%															
Data Collection and Revisions	Everyone	11/16	11/22	100%															
Client testing	Everyone	11/16	11/22	100%															
Final Product																			
Final Product Client Testing	Everyone	11/23	11/29	100%															
Final Data Collection	Everyone	11/23	11/29	100%															
Final Report Draft	Everyone	11/23	11/29	100%															
Final Team Meeting	Everyone	11/23	11/29	100%															
Deliver Final Product to Client	Everyone	11/23	11/29	75%															
Final Documents																			
Final Notebook	Everyone	11/30	12/5	75%															
Write final report	Everyone	11/30	12/5	90%															
Prepare poster	Everyone	11/30	12/5	100%															
Review all final documents	Everyone	11/30	12/5	90%															
Final Poster Session	Everyone	11/30	12/5	100%															
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	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 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-PVC001020600HD/203391373
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-_

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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-PVC024006450HD/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**	
								OVERALL TOTAL:	**$291.49**	