

Pelvic Organ Prolapse Teaching Model



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Abstract

Pelvic organ prolapse occurs when the muscles in the pelvic region become weakened or damaged. Due to this weakening, the bladder, rectum, uterus, and vagina fall onto or into the vagina. Currently, there is no easy way to teach the pelvic organ prolapse quantification exam (POP-Q), which uses different measurement sites and distances to quantify the stage of prolapse. The goal of this project is to design and fabricate a dynamic, scaled-up model to simulate the different types and stages of pelvic organ prolapse. The model should be easy to manipulate and reset. The final design incorporates the use of rods to simulate the prolapse. Future work includes calibrating and testing the model, as well as incorporating a lateral prolapse mechanism.

Problem Statement

Background

- Pelvic prolapse
 - Muscles supporting pelvic organs weaken (Herschorn, 2004)
- Types of prolapse
 - Cystocele
 - Rectocele
 - Uterine
 - Vault
- Pelvic Organ Prolapse Quantification Exam (POP-Q)
 - Used by gynecologists since 1996 (Geiss *et al.*, 2007)
 - Describes, quantifies, and stages pelvic support in women (Flesh, 2008)
 - Anatomical landmarks are used as measurement sites (Figure 1)
 - Different stages depending on severity (Figure 2)

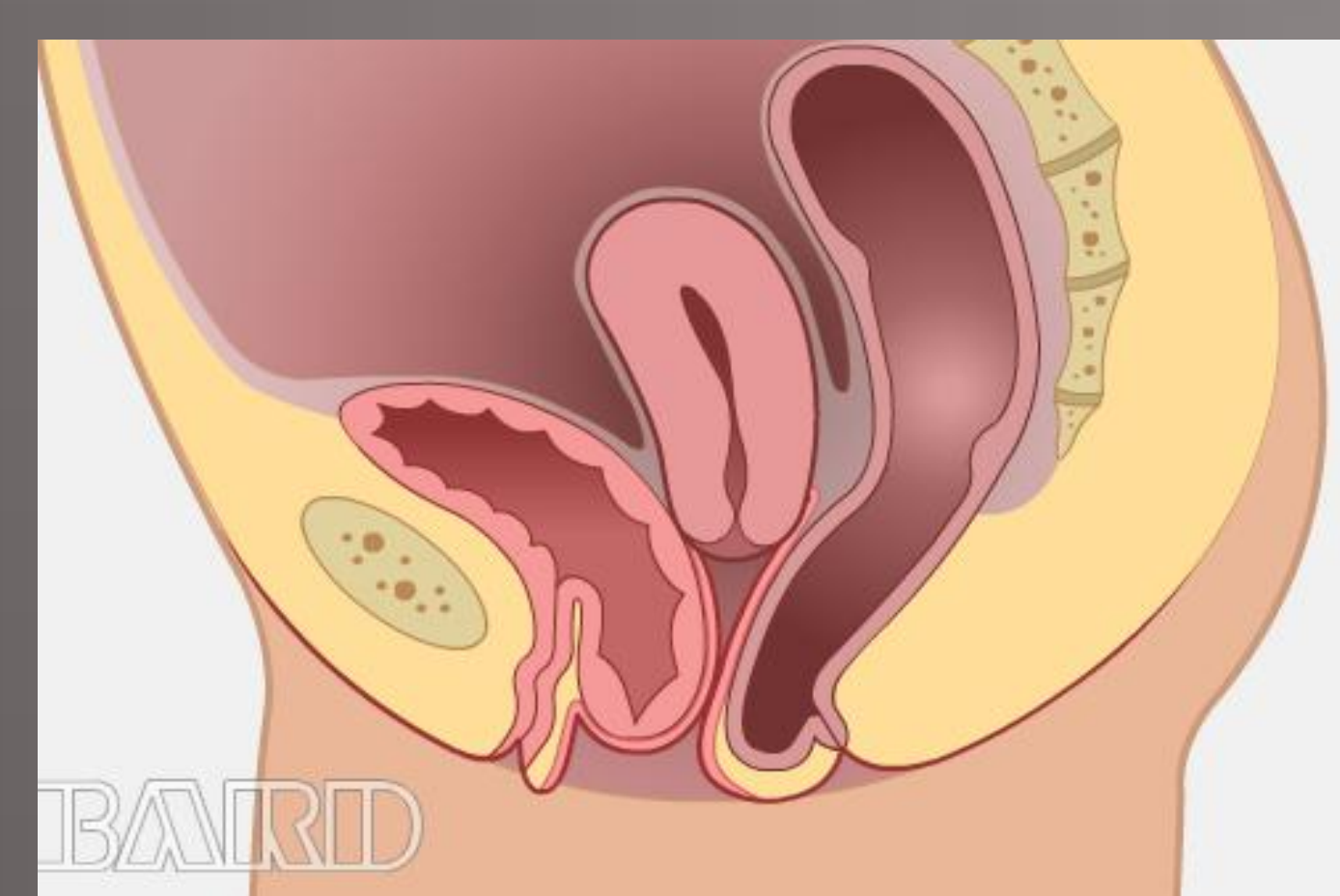
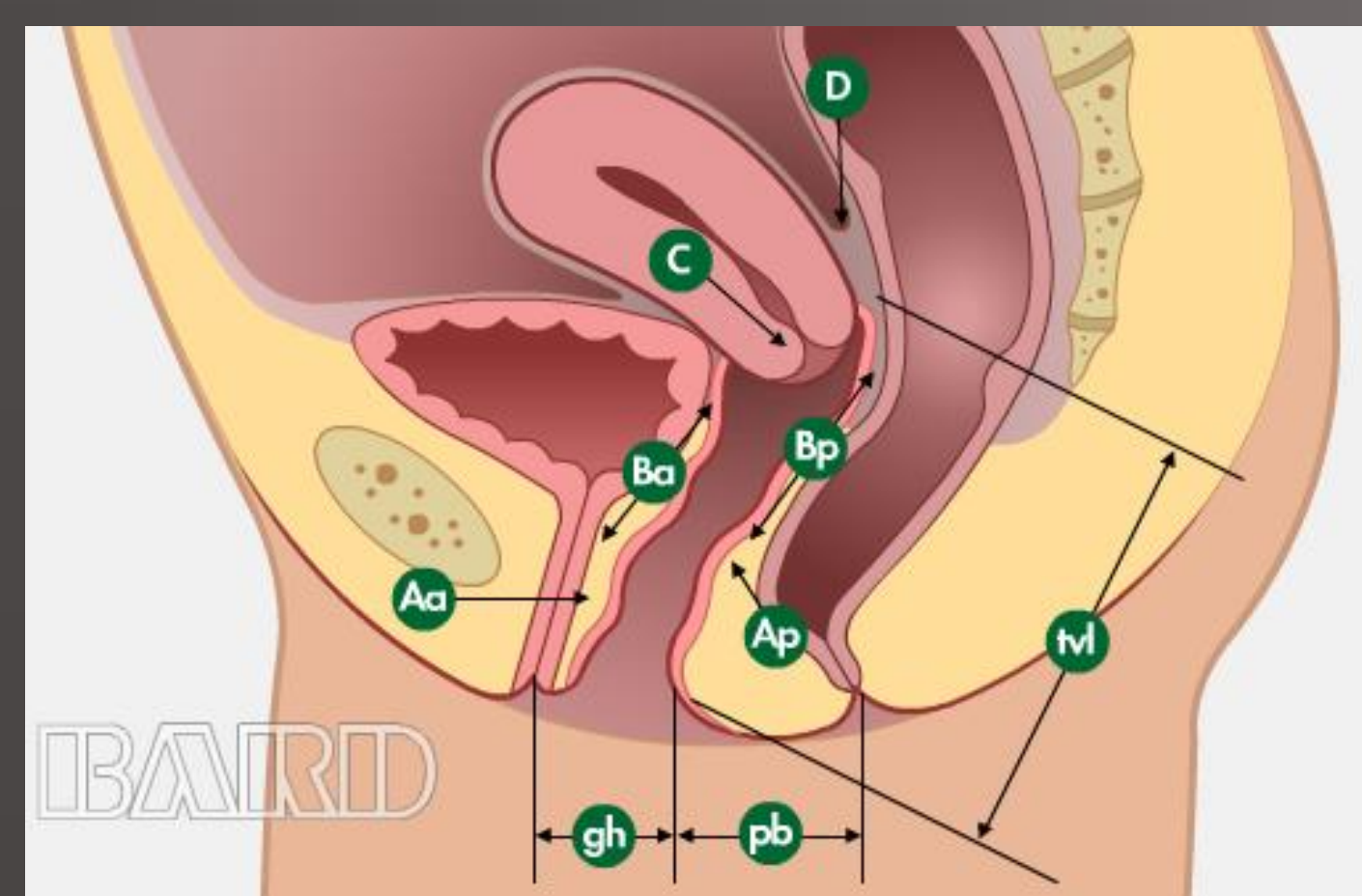


Figure 1. POP-Q measurement sites

Figure 2. Stage 2 cystocele

Motivation

- Approximately 50% of all women who bear children will experience some type of prolapse later in their lifetime (Beus, 2003)
- POP-Q Exam is complex and confusing
- Currently no dynamic model to teach residents how to perform the POP-Q exam

Client Requirements

- Must contain bladder, uterus, rectum, and vagina
- Simulate three different stages (four for vault) of cystocele, rectocele, uterine, and vault prolapse
- Scaled-up vaginal tube
- Easy to use, manipulate, and reset
- Components easy to replace if repair is necessary

Final Design



Figure 3. Box structure



Figure 4. Rod actuation

Box structure

- Mounting surface for silicone tube on inside
- Ovular hole in front serves as vaginal opening as seen from view of physician

Vaginal Tube Assembly

- Hollow cylinder made of Ecoflex™ 0030 durability silicone (Figure 5)
- Attached to front and back inside surface of box with Velcro™ to prevent movement of tube

Box Layout

- Wooden dowel rods on top and bottom enter box at 35° angles pointed towards front face
- Top and bottom rods in back enter box at 65° angles pointed towards front face
- Middle rod in back has a silicone attachment that serves as closed end of vagina (Figure 3)
- Clay organ-like shapes attach to end of dowel rods (Figure 5)
- Silicone cervix attaches to center dowel in back with magnet

Model Actuation

- Rods move in and push on silicone to simulate prolapse, can move up to 20 cm into box and can return to original position
- Rods held in position with pin and hole system (Figure 4)
- Type and stage of prolapse quantified from front of model (Figures 6,7)

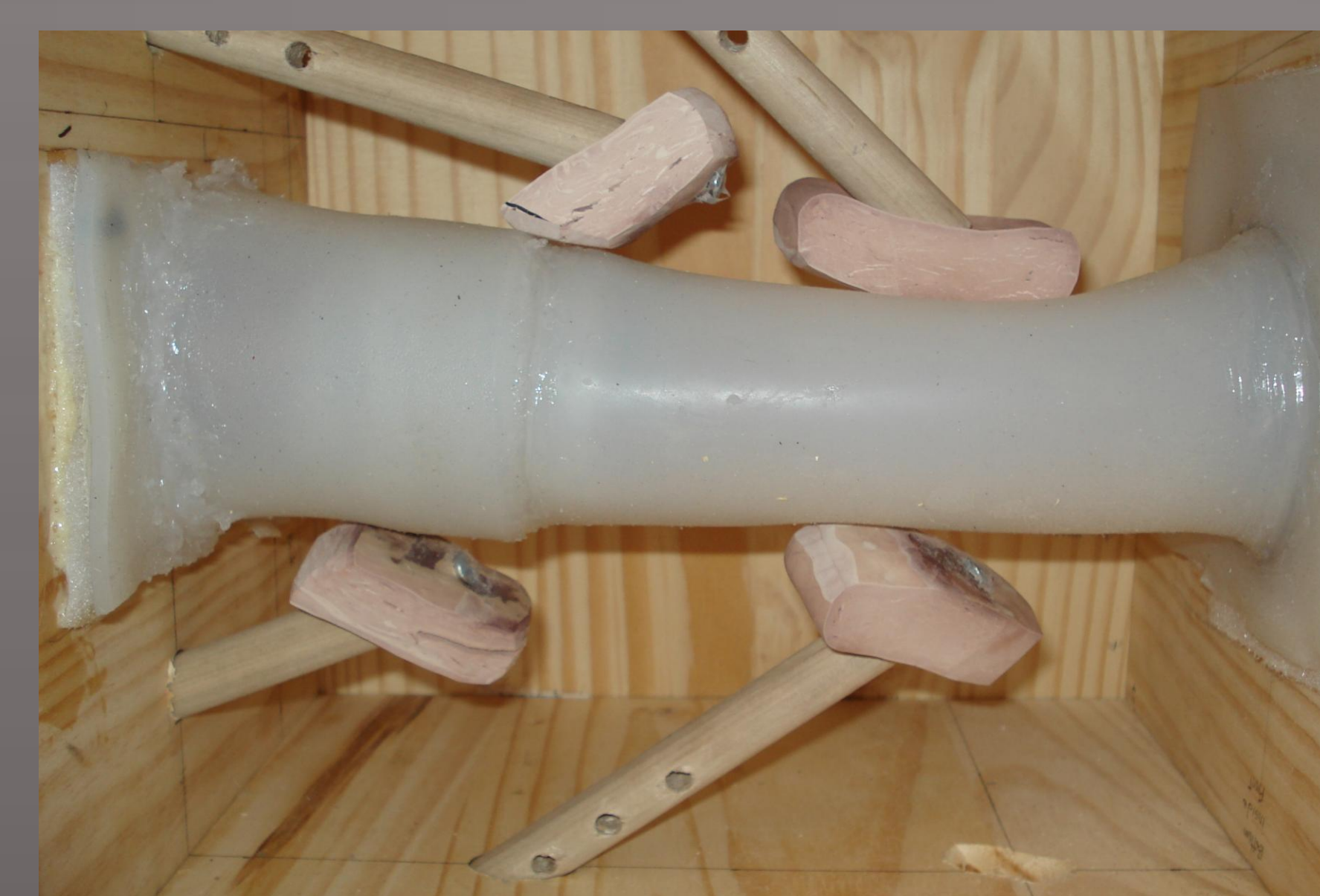


Figure 5. Clay organs and silicone tube



Figure 6. No prolapse



Figure 7. Prolapse

Testing Procedure

•Calibration

- Perform with Dr. Tova Ablove, who has extensive experience with POP-Q exam
- Move each organ and quantify with measurement stick (Figure 8)
- Label different stages of prolapse on each rod

•Testing

- Participants include doctors and residents with POP-Q exam experience
- Model will display four different types of prolapse
- Record whether participants can successfully identify shown types of prolapse



Figure 8. Measurement device

Cost Analysis

Item	Cost
Hinges	2.78
2 oz. Gorilla Glue	4.98
Hook & Eye	1.69
Screws	5.57
Shelving (Pine)	21.94
3/4" Magnetic Disks	2.49
Wooden Dowels (Various Sizes)	10.68
Tube Straps	1.98
Ecoflex 00-30 Trial Kit	28.67
Sil-Poxy Silicone Adhesive-3 oz. Tube	27.34
Sculpey Clay	5.97
Total Cost	~\$117.09

Future Work

Additional future tasks include calibration, testing, modifying the front silicone attachment, increasing the size of the model, and adding a mechanism to simulate lateral prolapse. Modifying the silicone attachment could be accomplished by fabricating a single mold of the tube and attachment. This change could help prevent the silicone attachment from moving with the organs when prolapse is being simulated. To further meet the specifications of our client, a model that is 5 times actual size would be ideal. Also, including a mechanism for lateral prolapse will make the model more versatile and realistic, but will involve complete reconstruction of the silicone tube support system.

References

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