

Radially Expanding Uterine Cervical Dilator

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Outline

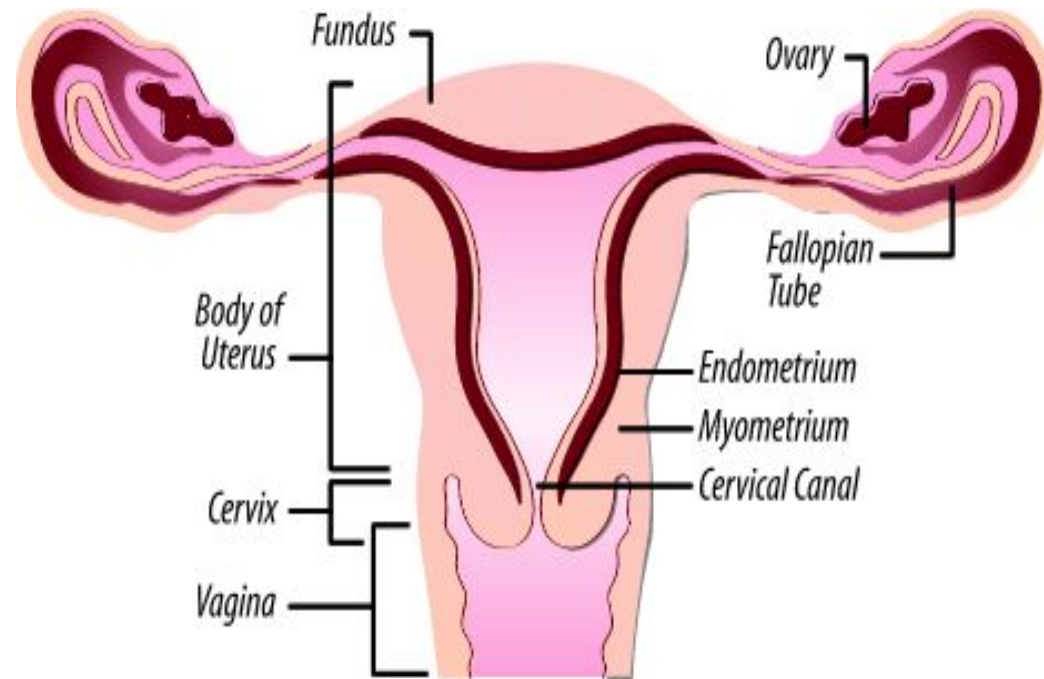
- Problem Statement
- Background Information
- Design Specifications
- Designs and Matrix
- Future Work

Problem Statement

The current procedure for dilating the cervix requires a doctor to use progressively thicker dilators until the desired diameter is reached. This method is very tedious for the surgeon and may put patients at a higher risk for a uterine perforation. To decrease the risk of a uterine perforation, we are going to make a device that, once inserted through the cervical canal, can be controlled by a surgeon to radially dilate the cervix to a desired diameter as indicated on a dial.

Background Information

- Anatomy of uterus
 - Average length of uterus
 - 7 cm
 - Average length of cervical canal
 - 3.5 cm
 - Average length of vaginal canal
 - 15 cm
- Procedures
 - Cleaning uterus
 - Sample of tissue
 - Termination of pregnancy
 - Miscarriage



Existing Products

Hegar Dilators



Pratt Dilators



Problems

- Can be very difficult to insert into cervical canal
- Higher risk of perforating uterus
- Tedious and time consuming

Product Design Specifications

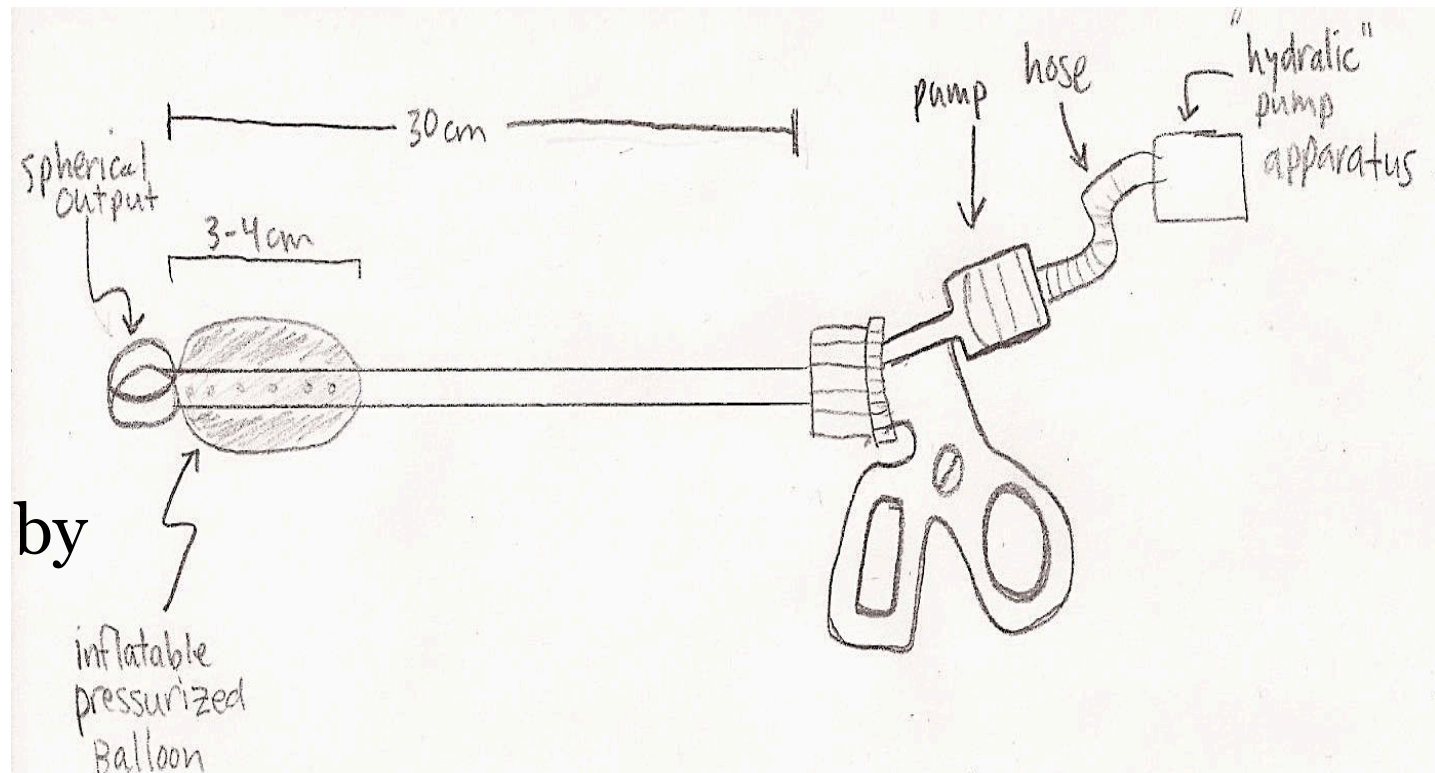
- Minimum size: 3 mm in diameter
- Maximum size: 1 cm in diameter
- Expansion while in cervical canal
- Radial expansion
- Expansion in increments of 1 mm in diameter
- Dial to control expansion and indicate diameter dilated
- Indicator to let doctor know when dilator is completely inserted into cervical canal
- Total length for ideal prototype: ~30 cm

Design 1

- Uses balloon
- Hydraulic pump inputs fluid to balloon
- Indicator of total dilation available in separate apparatus

Problems

- Inconstant pressure throughout balloon
- Not favored by client

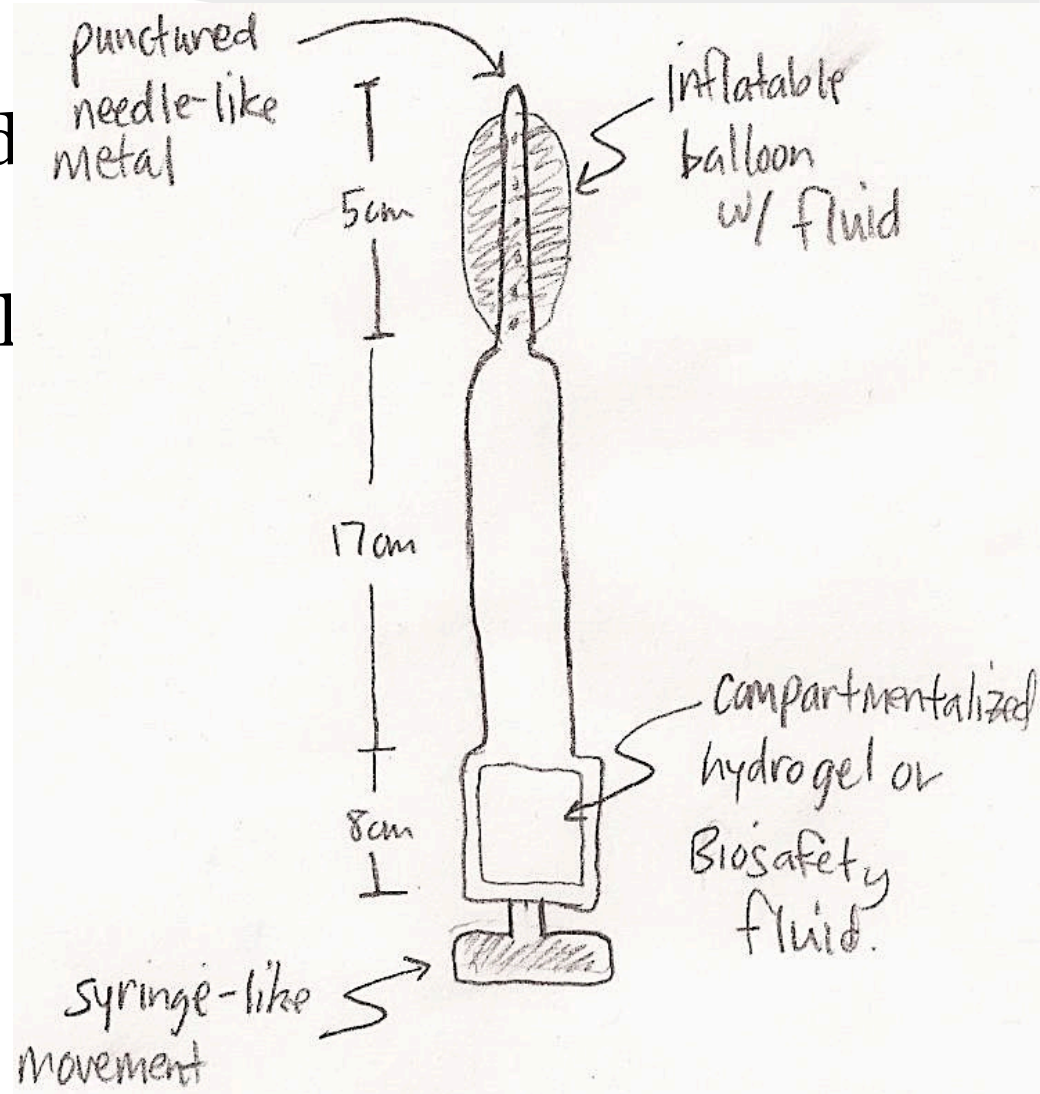


Design 2

- Uses balloon
- Syringe-like input of fluid to balloon
- Plunger rod features total cervical diameter

Problems

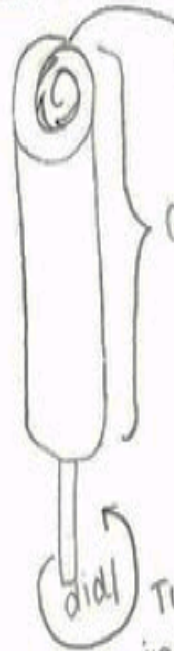
- Inconstant pressure throughout balloon
- Lack of force using syringe



Design 3

- Coil-like design
- Uses dial to control dilation
- Has stopper-like feature as indicator of total entry to cervix
- Easy to use

Initial shape (≈ 3 mm diameter)



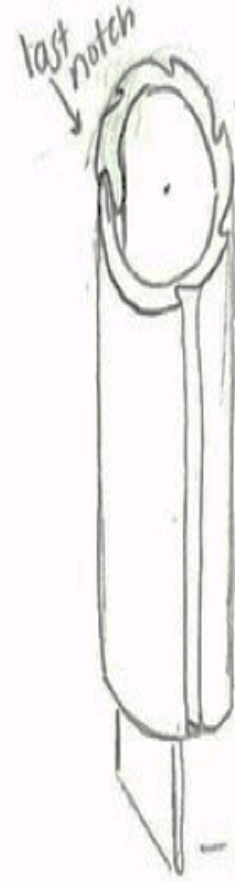
material thin but flexible.
(springs back to shape)

about 3 inches in
length

Turn dial, spins
inner core against
"spring" force.



DILATED shape



notches
correspond
to diameter
(keep device
open)

- How do we
connect?

Problems

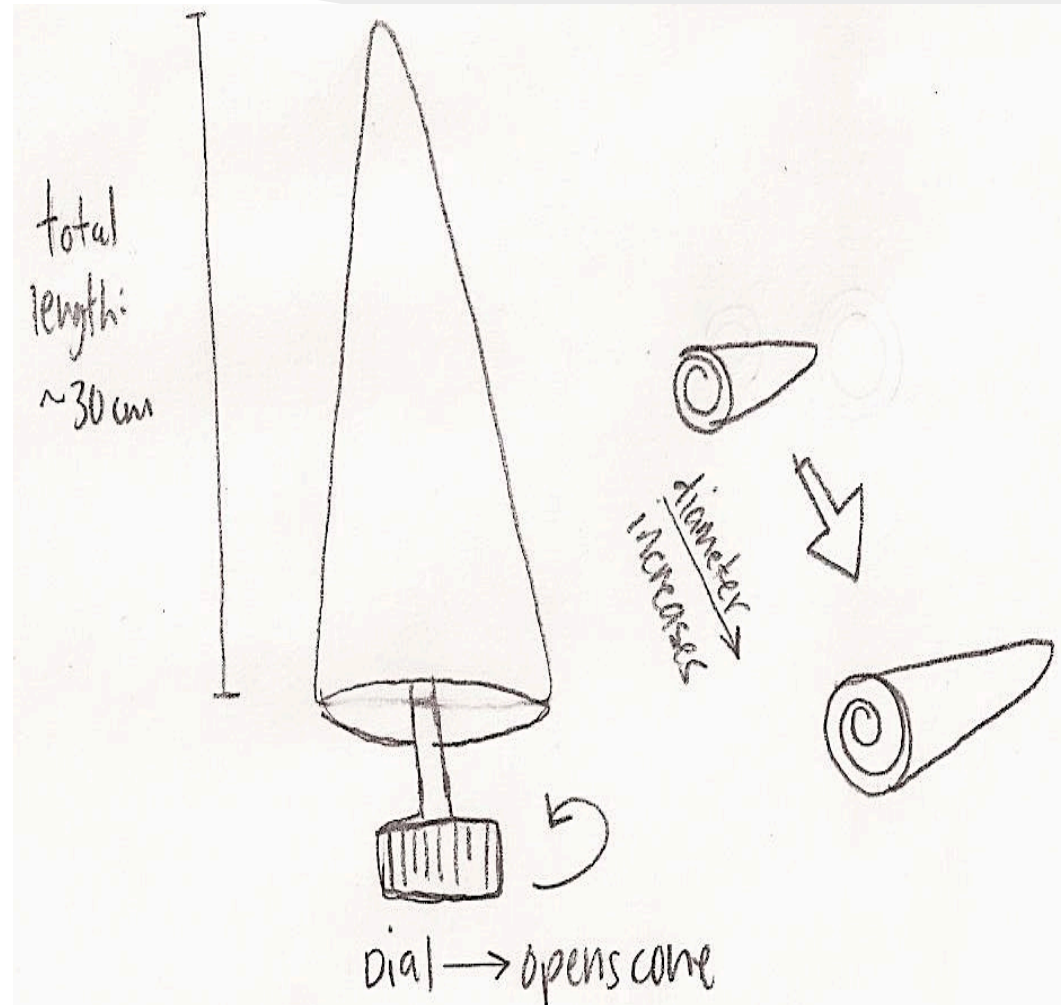
- Materials
- Dial mechanism

Design 4

- Cone shape
- "Twisted" into cervix, not pushed directly up
- Uses dial
- Opens into 4 panels once dilation is complete

Problem

- Cervical canal dilated unevenly



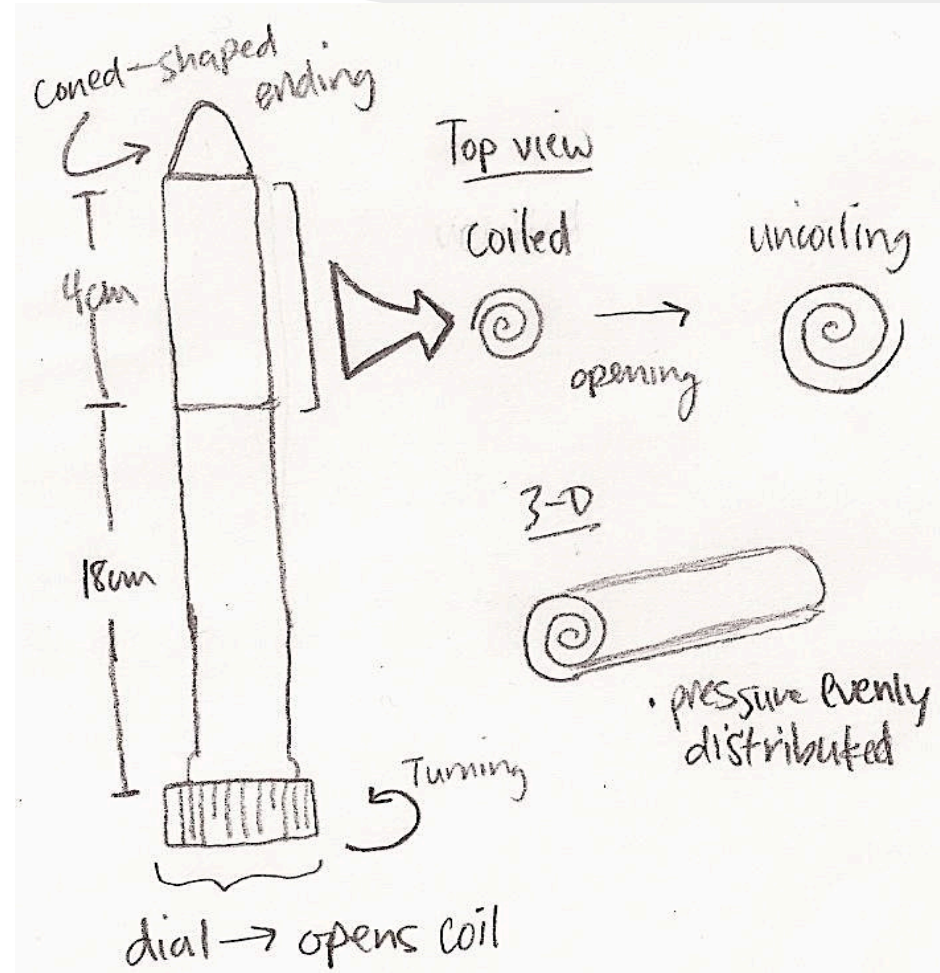
Design Matrix

Criteria	Weight	Design 1	Design 2	Design 3	Design 4
Cost	10/100	4	2	9	9
Ease of Use	20/100	11	8	18	17
Feasibility	20/100	12	7	17	17
Safety	25/100	16	13	24	22
Durability	25/100	14	15	23	23
Total	100	57	45	91	88

Higher numbers — more favorable

Future Work

- Continue researching materials
- Create more specific schematics of Design 3
- SolidWorks
- Prototype
- Testing and evaluation



Acknowledgements

- Dr. Randolph Ashton
- Dr. Dan Lebovic

References

Images

http://monarchmedicalproducts.com/products_2012/category.php?catid=59

<http://www.medline.com/product/Pratt-Uterine-Dilators/Uterine-Dilators/Z05-PF17241>

http://www.nuff.org/health_theuterus.htm#9

<http://www.cookmedical.com/wh/datasheet.do?id=6078>