

UTERINE COMPRESSION DEVICE: A TREATMENT FOR POST-PARTUM HEMORRHAGE

Group Members:

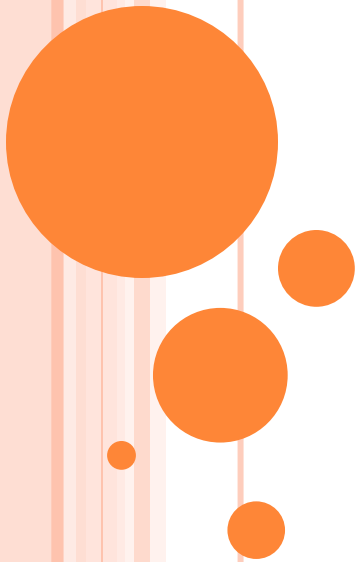
**Kelsi Bjorklund (Team Leader), Jacob Stangl
(BWIG), Emma Weinberger (BSAC), Ashley
Qunn (Communicator)**

Advisor:

Tracy Puccinelli, Ph.D.

Client:

Dr. Jay Lick, D.O.



OVERVIEW

- Client Description
- Problem Definition
- Current Methods
- Product Design Specifications
- Design Alternatives
- Design Matrix
- Materials Matrix
- Preliminary Testing
- Ethical Considerations
- Future Work



CLIENT DESCRIPTION

- Dr. Jay Lick
 - OB/GYN with UW Health
 - Increase in post-partum hemorrhage (PPH)
 - Result of increased prevalence of caesarean sections
- Proposal
 - Create a uterine compression device that can be absorbed into the body
 - Compresses the uterus in all planes



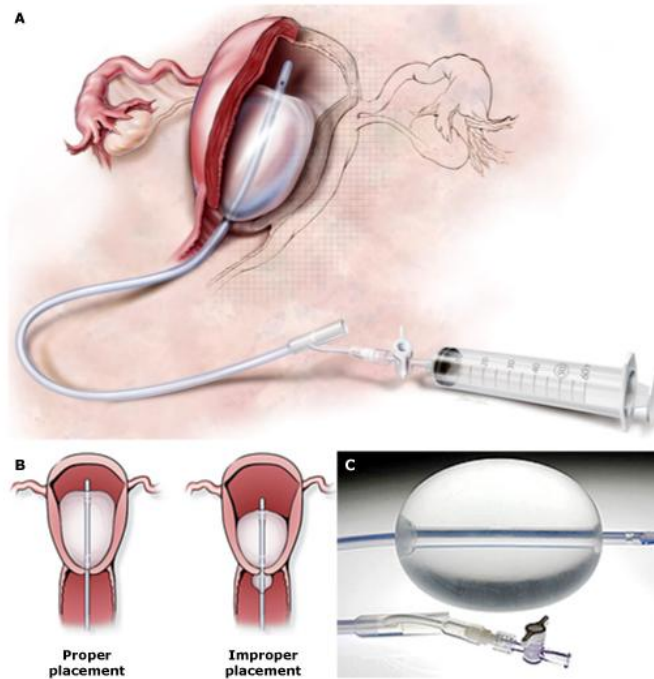
PROBLEM DEFINITION

- Post-partum Hemorrhage- hemorrhage after delivery
 - Over 500 ml following vaginal delivery
 - Over 1000 ml following caesarean delivery
- Major cause of maternal mortality and maternal morbidity
- Results from placenta accreta and uterine atony



CURRENT METHODS

- Balloon tamponade
 - Bakri Balloon



http://www.health-pic.com/EX/09-19-01/Bakri_balloon.jpg



CURRENT METHODS

- B-Lynch sutures
 - 91.7% success rate [1]
- Hysterectomy
 - 94-99% success rate [1]
- Arterial ligation
 - 80-96% success rate [1]
- Arterial embolisation
 - 70-100% success rate [1]
- Tourniquet [2]



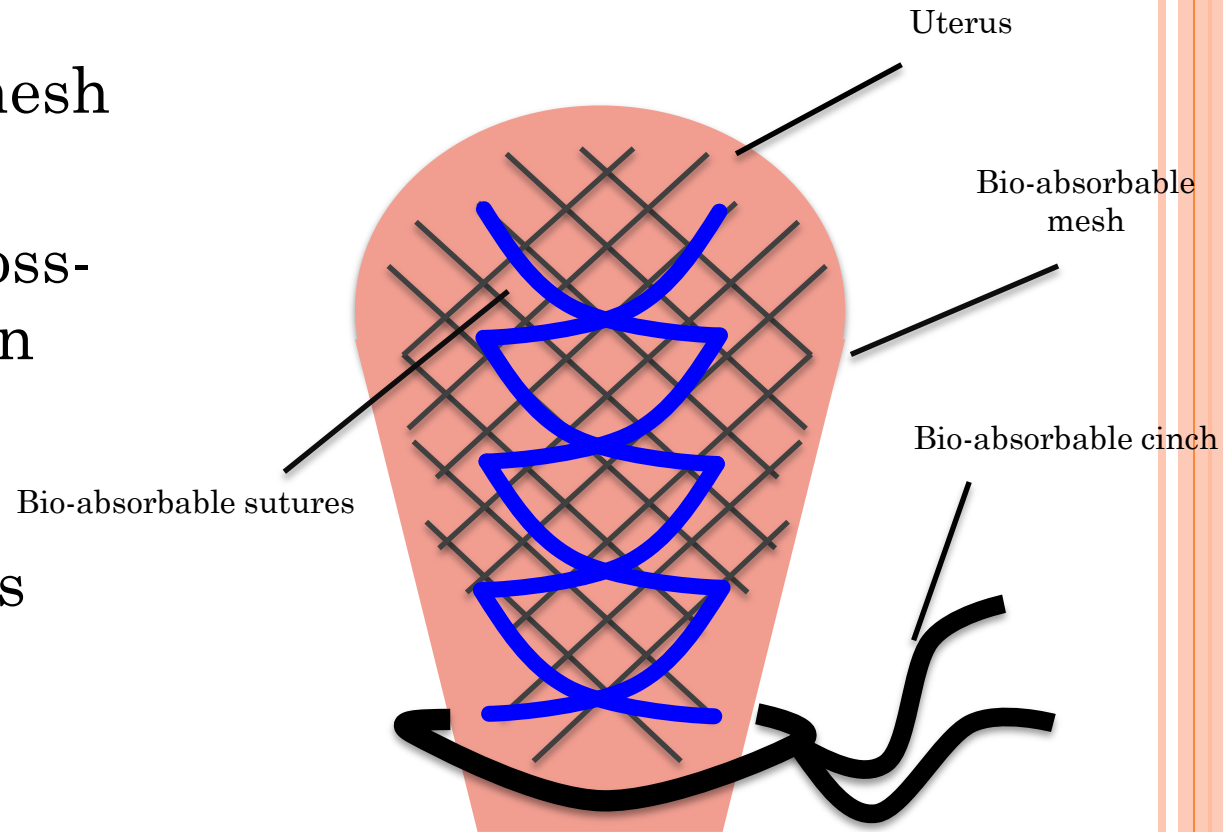
PRODUCT DESIGN SPECIFICATIONS

- Bio-absorbable
- Supply a minimum pressure of 100 mmHg
- Apply pressure for at least 24 hours
- Stop hemorrhaging substantially during and post surgery
- Absorbed within 6 months



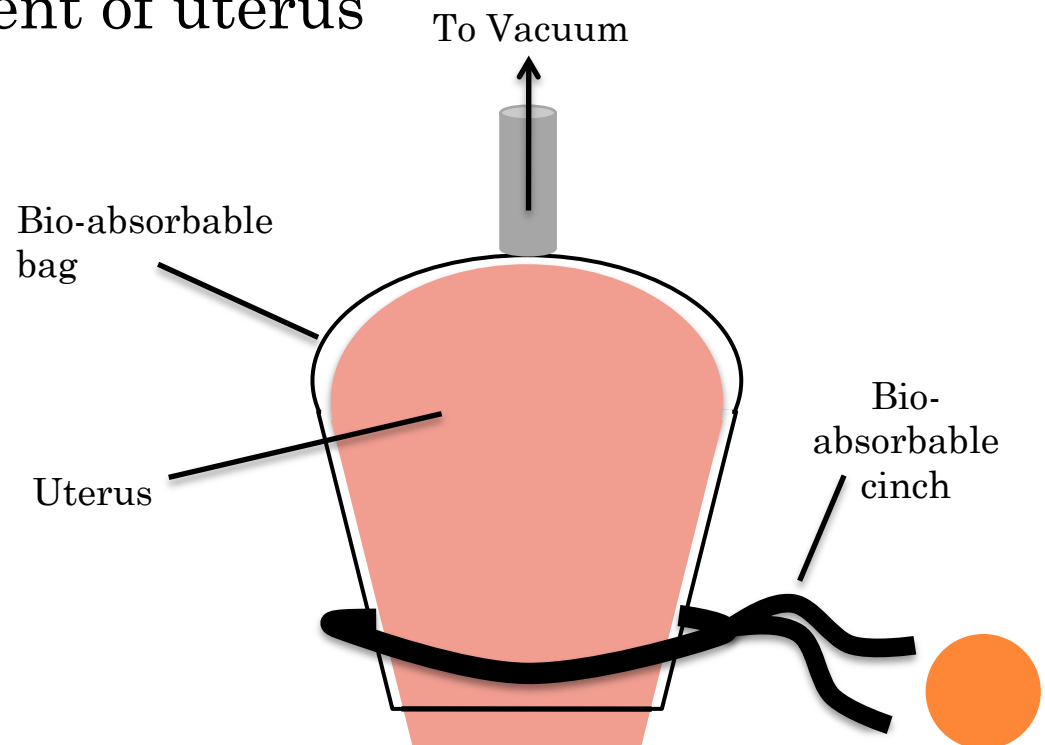
STRUCTURE DESIGN ALTERNATIVES: CORSET

- Bio-absorbable mesh
- Fastened by biocompatible cross-linking sutures on lateral sides
- Cinch at lower segment of uterus



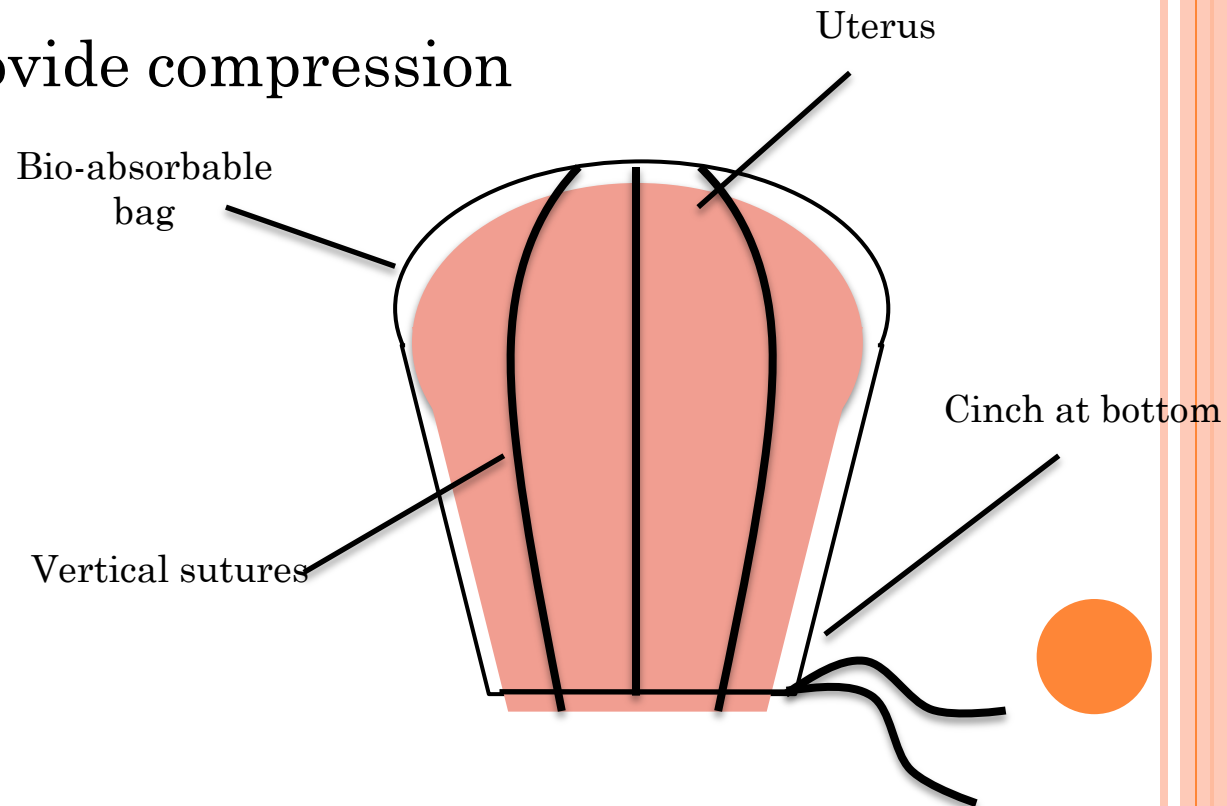
STRUCTURE DESIGN ALTERNATIVES: VACUUM

- Bio-absorbable bag
- Trocar inserted at fundus
- Cinch at lower segment of uterus



STRUCTURE DESIGN ALTERNATIVES: PARACHUTE

- Bio-absorbable parachute-like sheet
- Cinch at lower segment of uterus
- Thick sutures fastened lengthwise to provide compression



DESIGN MATRIX

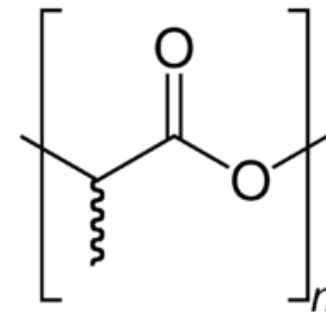
Category	Weight	Design		
		Corset	Vacuum	Parachute
Cost	15	13	8	12
Ease of Use	25	20	18	23
Effectiveness	35	27	35	25
Manufacturability	25	20	24	15
Total	100	80	85	75

MATERIAL ALTERNATIVES

- Materials: all bio-absorbable & FDA approved

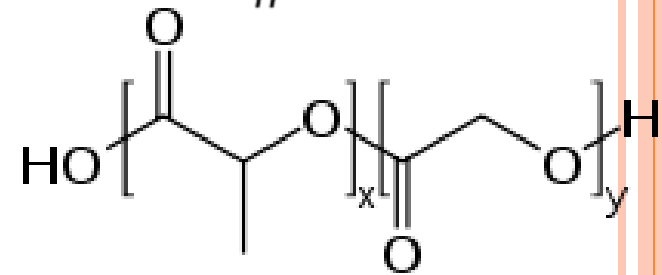
- Polylactic Acid (PLA)

- Hydrolysis in presence of water
- Degrades in 6-24 months



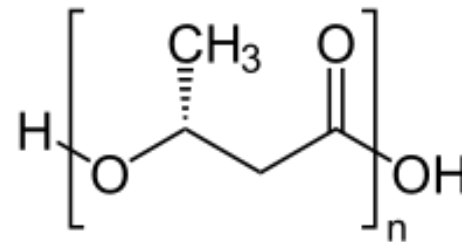
- Polylactic-glycolic acid (PLGA)

- Hydrolysis in presence of water
- Custom degradation time



- Polyhydroxybutyrate (PHB)

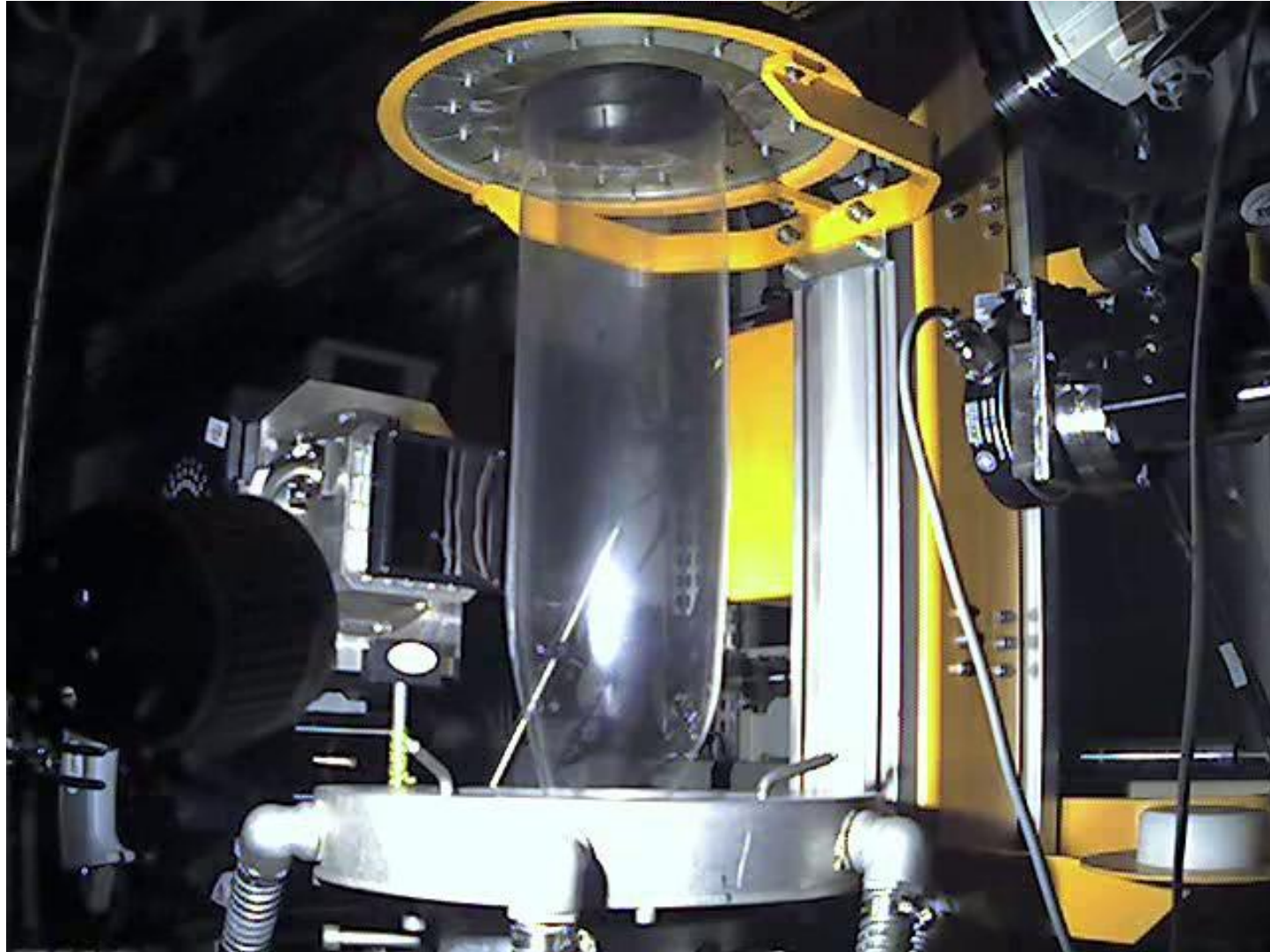
- Water insoluble
- Degrades in 6-12 months



MATERIALS MATRIX

Category	Weight	Material		
		PLA	PLGA	PHB
Cost	10	10	2	5
Biocompatibility	30	26	28	12
Mechanical Properties	25	22	18	22
Degradation Time	15	10	15	10
Manufacturability	20	18	10	18
Total	100	86	73	67

PRELIMINARY TESTING – FILM EXTRUSION



<http://www.esrf.eu/UsersAndScience/Experiments/CRG/BM26/pictures/BM26B/LDPE-film-blowing.jpg>



ETHICAL CONSIDERATIONS

- Patient health and fertility
- Available techniques: intellectual property infringement
- Possible animal testing
 - Follow Research Animal Resources Center (RARC) guidelines



FUTURE WORK - TESTING

- Current mechanical characterization of materials
- Once prototype formed, use of excised cow uterus for testing
- Possibility of sheep lab and testing upon live animals



ANY QUESTIONS?

- Acknowledgements
 - Tracy Puccinelli, Ph.D.
 - Jay Lick, D.O.
 - Tim Osswald, Ph.D.
 - Luisa Lopez
 - Ron Magness, Ph.D.



REFERENCES

- [1] **Rath, W., A. Hackethal, and M. K. Bohlmann.** 2012. Second-line treatment of postpartum haemorrhage (PPH). *Arch. Gynecol. Obstet.* **286**:549-561. doi: 10.1007/s00404-012-2329-z.

- [2] **Breen, M.** 2012. Temporary treatment of severe postpartum hemorrhage. *International Journal of Gynecology & Obstetrics.* **118**:253-254. doi: 10.1016/j.ijgo.2012.04.008.

