

Placenta Extraction Model

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Client:

Dr. Lee Dresang
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Advisor:

Dr. Thomas Yen

Client Information

Dr. Lee Dresang

- Professor of Family Medicine at UW-Madison School of Medicine and Public Health
- Former board chair, current member of Advanced Life Support in Obstetrics (ALSO)
- Special interests: Women's health, Latino health, international health, and violence prevention



Background

Placenta

- Organ attached to the inside of the uterus
- Connects to the fetus by the umbilical cord
- Network of blood vessels that allow the exchange of nutrients and gases between mother and fetus



Background

- Normal birth
 - Baby is delivered
 - Umbilical cord clamped
 - Placenta delivered approx. 30 min after birth
- Manual extraction required
 - Placenta is retained in uterus
 - Occurs in 3% of vaginal deliveries
 - Can lead to life-threatening hemorrhaging if not removed
 - Postpartum hemorrhaging number one cause of maternal death in developing countries

Problem Definition

- Simulators exist to practice many birthing procedures
- No model exists to practice manual extraction of placenta
- Procedure currently learned using textbooks

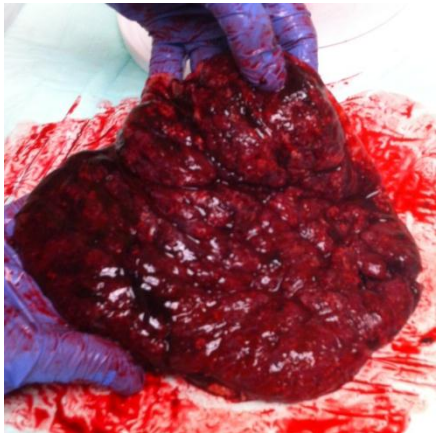


Design Criteria

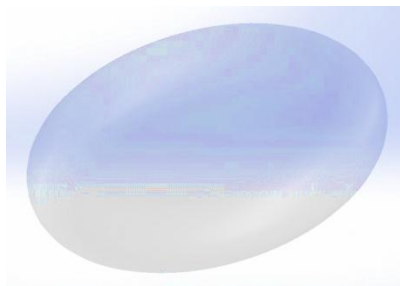
- Client Proposal:
 - Build a <\$100 model for teaching manual placenta extraction
 - Incorporate uterus and placenta
 - Integrate into current birthing simulator used in courses taken by 150,000 maternity care providers in over 60 countries

Design Components

- Silicone chosen as material for uterus and placenta
- Two main design components:
 - Realistic attachment mechanism
 - Reliable feedback to evaluate success of extraction



Real Placenta



SolidWorks Placenta
Model



SolidWorks Uterus
Model

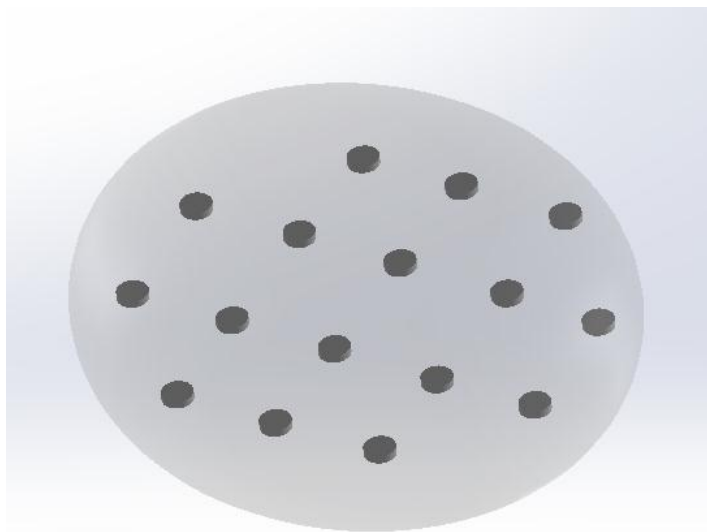
Attachment Design Matrix

Criteria	Weight	Velcro	Snaps	Magnets	Suction Cups
Durability	3.5	6	9	7	5
Accuracy	2.5	6	3	10	3
Cost	2	9	5	3	7
Ease of use	1.5	7	5	8	4
Ease of manufacturing	0.5	6	3	8	3
Total (out of 100)	10	67.5	58	71.5	46.5

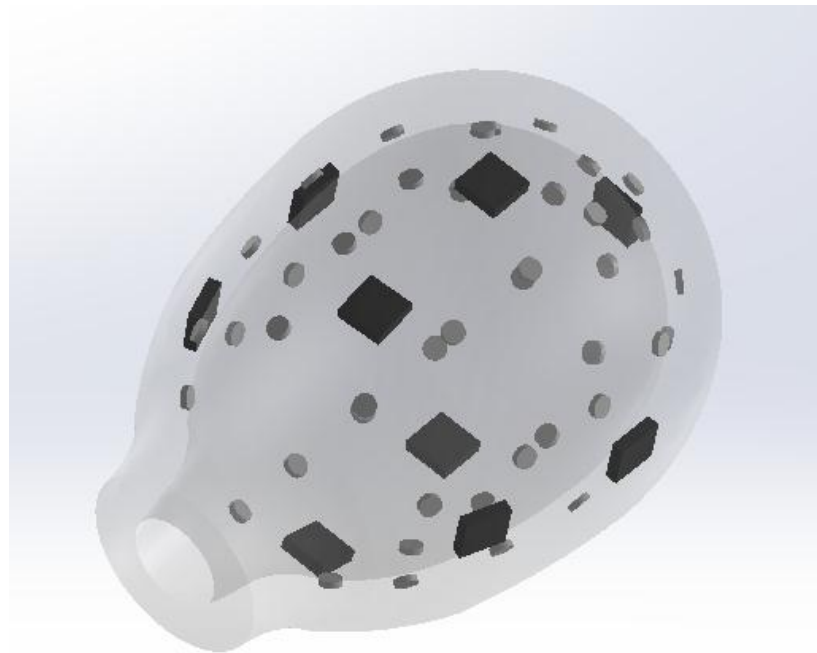
Feedback Design Matrix

Criteria	Weight	Magnetic Field Sensor	Force Sensor	Camera	Transparent Uterus
Quantitative Feedback	4	8	6	2	0
Cost	2.5	3	1	5	10
Ease of use	2	4	4	7	10
Power Consumption	1	5	2	6	10
Ease of implementation	0.5	4	4	6	8
Total (out of 100)	10	52.5	38.5	43.5	59

Final Design



Placenta



Uterus

Future Work

- Construct molds for placenta and uterus
- Integrate attachment and sensors into silicone model
- Program video feedback of placenta location within uterus
- Test device with physicians
- Obtain data of students performing manual extraction with device and compare to those without device
- Patent device?

Acknowledgements

- Client: Dr. Lee Dresang
- Advisor: Dr. Thomas Yen
- Greg Gion

References

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<http://www.mayoclinic.com/health/placenta-previa/DS00588>

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