Transcervical Chronic Villus Sampling Model

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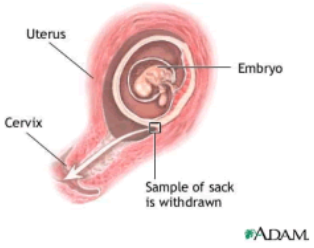
Problem Statement

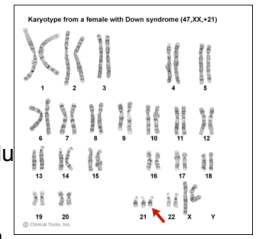
- To develop a realistic model to replicate the anatomy of a pregnant woman
  - Natural feel
  - Ultrasound image
- Construct the model out of affordable, “ultrasoundable” materials
- Model used repeatedly to practice transcervical CVS procedure
- Easy setup and clean up



http://www.dhss.mo.gov/Genetics/TalkCornerArchives/7_07PrenatalDiagnostic.html

Motivation

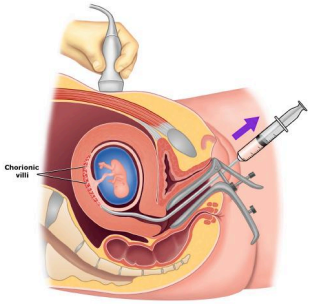
- Most expecting parents want to know
- CVS allows access to this knowledge
- The CVS procedure is very difficult
  - Accompanied by significant risks
- Currently, instruction and practice carried out during actual procedure
- No simulation exists
- Creating a model to simulate procedu
  - Reduces risk to patients
  - Increases successful sampling rate
    - Provides access to more information



http://www.dhss.mo.gov/Genetics/TalkCornerArchives/7_07PrenatalDiagnostic.html

Chronic Villus Sampling

- Genetic screening of fetus
- Earlier diagnosis than amniocentesis
- Two approaches
  - transabdominal
  - **transcervical**
- Risks (low, 0.2-0.4%)
  - Miscarriage
  - Birth defects
- Chorionic villus - placental sample



http://www.uptodateonline.com/patients/content/images/obst_pix/Transcervical_CVS.jpg

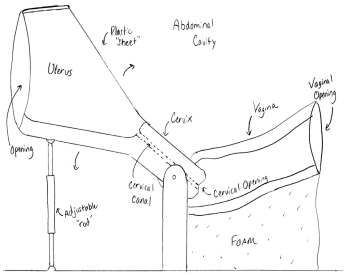
Client Requirements

- Doctors and interns in a clinical setting
- Highly limited by anatomy
- Points of emphasis:
  - “Ultrasoundable”
  - “Feel” of cervix/uterus material
- Concerned with ease of replacing amniotic sac and placental sample between uses

http://www.obgyn.net/pregnancy-birth/images/YDB-images/Fig13-05a_sm.jpg

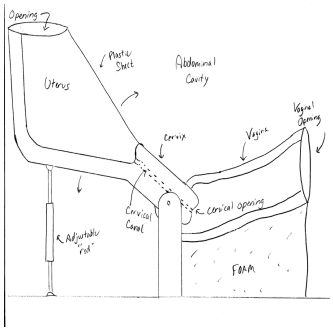
Design 1 – Plastic sheet uterus

- Top half of uterus constructed of a thin plastic material
- Cervix and bottom half of uterus made of silicone polymer
- Cervix/uterus rotates
- Advantages
  - Thin plastic ultrasound compatible
- Disadvantages
  - Plastic not as strong
  - Not rigid
  - Amniotic sac “bubble”



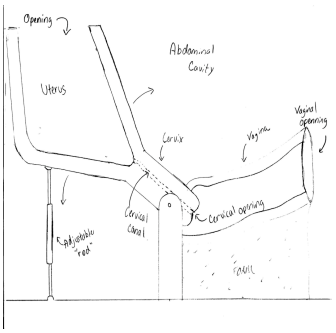
Design 2 – Plastic sheet with elbow

- Top half of uterus constructed of a thin plastic material
- Cervix and bottom half of uterus made of silicone polymer
- Cervix/uterus rotates
- Uterus elbow design
- Advantages
  - No amniotic sac “bubble”
  - Thin plastic ultrasound compatible
- Disadvantages
  - Plastic not strong/rigid



Design 3 – Rigid model with elbow

- Uterus and cervix constructed with Smooth-On EcoFlex
- Plastic bag filled with water to simulate amniotic sac
- Placenta and amniotic sac more stable
- Uterus elbow design
- Cervix/uterus rotates
- Advantages
  - No amniotic sac “bubble”
  - More rigid structure



Design Matrix

Design Number	*Realistic “Feel” (50)*	*Anatomical Accuracy (20)*	*Ease of Use & Setup (10)*	*Manufacturing (10)*	*Cost (10)*	*Total (100)*
1	20	15	6	10	10	61
2	20	20	7	8	8	63
3	45	20	9	7	8	89

Future Work

- Manufacture design option #3
- Brainstorm and design a support system for the model
  - Raising and lowering capabilities
- Conduct “dry” test runs with client
- If time permits, design and build abdominal wall

http://wichita.kumc.edu/support/lab/images/female_reproductive.jpg

Questions?