Endotracheal Tube Adaptor

Team Members:
- Evan Joyce - Team Leader
- Ozair Chaudhry - Communicator
- Ryan Childs – BSAC
- Tim Barry - BWIG

Advisor:
- Professor Paul Thompson

Client:
- Mark E. Schroeder, MD
Client Background

• Mark Schroeder, MD
  – Anesthesiologist at UW-Hospital
  – Associate professor
• 2-3 patients/month require medication during surgery
• Administration of aerosolized medication to anesthetized patients
  – New metered dose inhaler (MDI) are incompatible with his current adaptor
  – Albuterol and Ipratropium medications
Why build an adaptor?

- Currently uses the “Bronchodilator Tee” by Boehringer Labs
  - Adaptor connecting MDI, endotracheal tube, and anesthesia circuit
- Medication delivery without compromising circuit
  - 4-5L/min gas flow
  - Needs to be a closed circuit
  - Prevent dilution of anesthesia mixture
Why a New Adaptor is Needed

• Propellant and geometrical changes
  – HFA vs. CFCs--environment
  – Actuation counter--patient knowledge

• New canister
  – GlaxoSmithKline
  – Nipple piece is incompatible
Existing Adaptors

- Bronchodilator Tee
- Nebulizer
- Syringe and old MDI adaptor
- Other patents in various shapes and sizes
Client Requirements

• Must Have Features
  – Adaptor must be compatible with the new MDI
  – Maintain 4-5L/min airflow rate
  – 70% delivery efficiency
  – Needs to be sterilized after use with MetriCide

• Client Desirable Features
  – Prototype cost should be under $300
  – As “universal” as possible
  – Medication delivered directly above endotracheal tube
Design Alternative - Syringe

• **Basic Concept:** Adapter “Syringe” inserted into female Luer port and canister depressed to administer dose

• **Advantages**
  – Fits existing elbow
  – Adaptable
  – Ergonomically friendly

• **Disadvantages**
  – Fabrication
  – Could be misplaced
Design Alternative – Canister Tee

• Basic Concept: Modeled after existing device; top portion similar to MDI, bottom portion same as Bronchodilator Tee

• Advantages
  – Failsafe method
  – Already have geometry

• Disadvantages
  – Efficiency issues
  – Difficult/expensive to fabricate
Design Alternative – The “Y”

• **Basic Concept:** Uses a “Y”-like geometry to minimize the injection to gas flow angle

• **Advantages**
  – Most efficient
  – Adaptable

• **Disadvantages**
  – Bulky
  – Hard to sterilize and fabricate
## Design Matrix

<table>
<thead>
<tr>
<th></th>
<th>Efficiency ( .3 )</th>
<th>Adaptability ( .25 )</th>
<th>Ease of Use ( .15 )</th>
<th>Fabrication ( .1 )</th>
<th>Sterilization ( .2 )</th>
<th>Total ( 1.0 )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Syringe</strong></td>
<td>8 (2.4)</td>
<td>10 (2.5)</td>
<td>9 (1.35)</td>
<td>8 (0.8)</td>
<td>9 (1.8)</td>
<td><strong>8.85</strong></td>
</tr>
<tr>
<td><strong>Canister Tee</strong></td>
<td>7 (2.1)</td>
<td>5 (1.25)</td>
<td>7 (1.05)</td>
<td>3 (0.3)</td>
<td>4 (0.8)</td>
<td><strong>5.5</strong></td>
</tr>
<tr>
<td><strong>The &quot;Y&quot;</strong></td>
<td>10 (3.0)</td>
<td>7 (1.75)</td>
<td>6 (0.9)</td>
<td>4 (0.4)</td>
<td>6 (1.2)</td>
<td><strong>7.25</strong></td>
</tr>
</tbody>
</table>
Possible Materials

- Metals
  - Aluminum
  - Brass
  - Stainless steel

- Plastics
  - High density polyethylene (HDPE)
  - Acrylonitrile butadiene styrene (ABS)
Future Work

- SolidWorks model of prototype
- Find company to manufacture device
- Test prototype
  - Anesthesia gas flow rate and delivery efficiency
  - Cleaning/durability
Special Thanks To...

- Mark Schroeder and the UW-hospital
- Professor Thompson
- Mark Childs for turning our ideas into sketches
References

1) http://findadoctor.uwhealth.org/providers/schroder_mar.jpg
2) http://www.osha.gov/dts/osta/anestheticgases/fig05.gif
3) http://www.boehringerlabs.com/broncho.htm
4) Pictures from client
5) http://www.myrespiratorysupply.com/images/nebulizer%20kit.jpg
6) http://www.patentstorm.us/patents/7207329/description.html
7) Sketches from Mark Childs
8) http://www.rajshreeoverseas.net/full-images/1061048.jpg
9) http://www.directplasticsonline.co.uk/webshop/categories/HDP_E%20White_100.jpg
QUESTIONS????