Design and Prototype Fabrication of a Neonatal Video Laryngoscope

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Dr. Neil Finer, Chief of the UCSD Medical Center’s Division of Neonatology, and Wade Rich, Research Coordinator for the Division of Neonatology, approached the Photonic Systems Integration Lab with a collaboration proposal.

- 25,000 extremely low birth weight infants born annually,
- Most require intubation, a difficult / traumatic process for neonates
- Current instruments designed for adults, not infants, esp. not neonates.
- Project goal: Working model of a neonatal video laryngoscope.
85 - 90% of extremely low birth weight infants need intubation.

Intubation requires 3 (average) to 10 tries

Multiple attempts lead to serious risks.

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Images from Manual of Emergency Airway Management, ed. Murphy and People’s Daily Online
Our goal was to create a working model *neonatal* video laryngoscope to evaluate the feasibility of a commercial device.

Images are from Karl Storz website, GlideScope website
Blade and Device Constraints

Constraints
• Blade Width
  • 2.5mm by 6.5 mm tip
• Variable Blade Angle
• Image Quality
  • Combination of Imager and Lighting
• Mechanical Properties
  • Strength
  • Heat
  • Texture
We identified a promising camera in the Medigus IntroSpicio CCD Video Camera, with a camera head measuring only 1.8 by 1.8 by 12 mm.
The most elegant solution is a tapered acrylic light pipe acting as the blade.

We make use of a Fraen coupling lens.

Calculated efficiency is just over 50%.
Acrylic blanks are cut at the right aspect ratio.

The edges are sanded, then flame-polished with a hydrogen-oxygen torch.

Blanks are heated to pliability, then stretched to form a taper.
Measured efficiency is 28%, but the LED is bright enough that this is sufficient.

Using an Inova X0 LED flashlight as the handle and light source, we created a working model.
The medical team tested the device on a Premi-Blue Neonatal Simulator (Gaumard).
Final Model
Conclusions and Future Directions

• Neonate anatomy guided our design.
• We met all the constraints of the project.
• Less expensive wafer cameras could be used to reduce cost.
• We would need a sterilizable device to perform a clinical trial
• Further modifications could be made
Thank you

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