Pediatric Nasotracheal Intubation Assist Device

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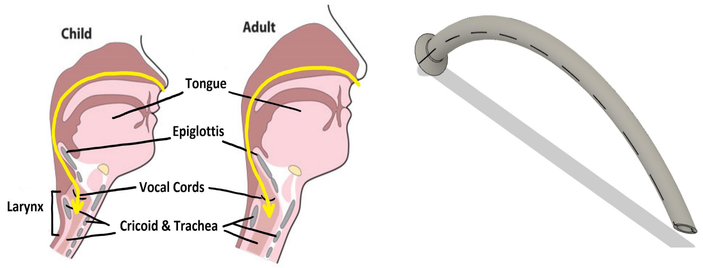
NEED

- Delays in airway management increase mortality rate from 1.8% to 11.8% in hospital and emergency settings[1]
- 57% of complications in pediatric oral intubation cases involve pre-existing airway or craniofacial abnormalities requiring a different method – nasal intubation[2]
- Differences in pediatric anatomy predisposes patients to airway obstruction and results in a sharper angle through which the fiberoptic scope must pass to reach the larynx and vocal cords

OBJECTIVE

Create an easily removable assistive device for pediatric nasal fiberoptic intubation especially in challenging, difficult airways



CONSTRAINTS

Project	Design
• Time – 9 months • Budget – $800 • Resources – St. Christopher's Hospital • Standards – ISO 10993, ASTM D624, ASTM D3767-03	• Differences in patient anatomy • Patient safety • Disruption of normal procedure

REQUIREMENTS

Outer Diameter	Inner Diameter	Length	Tear Strength	Flexibility
6.7 ± 0.2 mm	5 ± 0.2 mm	105 ± 0.2 mm	<14.3 N	(4.5×10^{-4} Nm^2)
✓	✓	✓	= 13.5 N	(2.9×10^{-4} Nm^2) p = 0.013

EXISTING SOLUTION

Nasal Trumpet (Nasopharyngeal Airway)

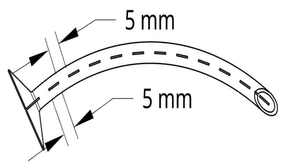
- Pros: opens obstructed airway, guides fiberscope (off label use)
- Cons: prevents insertion of endotracheal tube, increases time required to establish airway, requires manual cut

PROTOTYPE

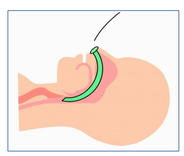
Prototype 1: 3D printed in Thermoplastic Polyurethane on Fused Deposition Modeling printer
Results: Prototype material was too stiff/brittle

Prototype 2: 3D printed Flexible Material on Stereolithography printer

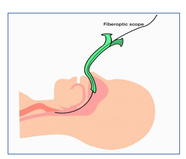
SOLUTION



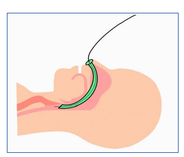
Engineering Drawing
Same dimensions as existing (20 French) trumpet with added perforations



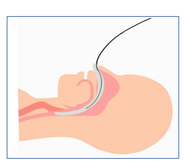
1. Nasal trumpet is inserted



3.Pre-manufactured perforations ensure the trumpet is easily removed from patient and allows for the ET to be placed



2. Nasal trumpet properly guides the fiberscope to the correct location



4. Fiberscope is inplace and ready to use

IMPACT

- Will benefit physicians, anesthesiologists, and patients by improving nasal intubation via fiberoptic guidance in emergencies

CONCLUSION

- Will assist in difficult pediatric nasotracheal intubation by reducing the risk of critical delays in airway management in cases where the mouth is inaccessible

REFERENCES

[1] B. Morshedi, "Management of the trauma patient's airway – pearls and pitfalls," (2015)

[2] Bai W, et al.; "Evaluation of emergency pediatric tracheal intubation by pediatric anesthesiologists on inpatient units and the Emergency Department," (2016)

[3] ASTM International. "ASTM D3767-03 Standard Practice for Rubber—Measurement of Dimensions," 2010.

[4] ASTM International. "ASTM D624-00(2020) Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers