

Abstract Title: Developing an Expandable Endotracheal Tube: The Process from Ideation to Patent

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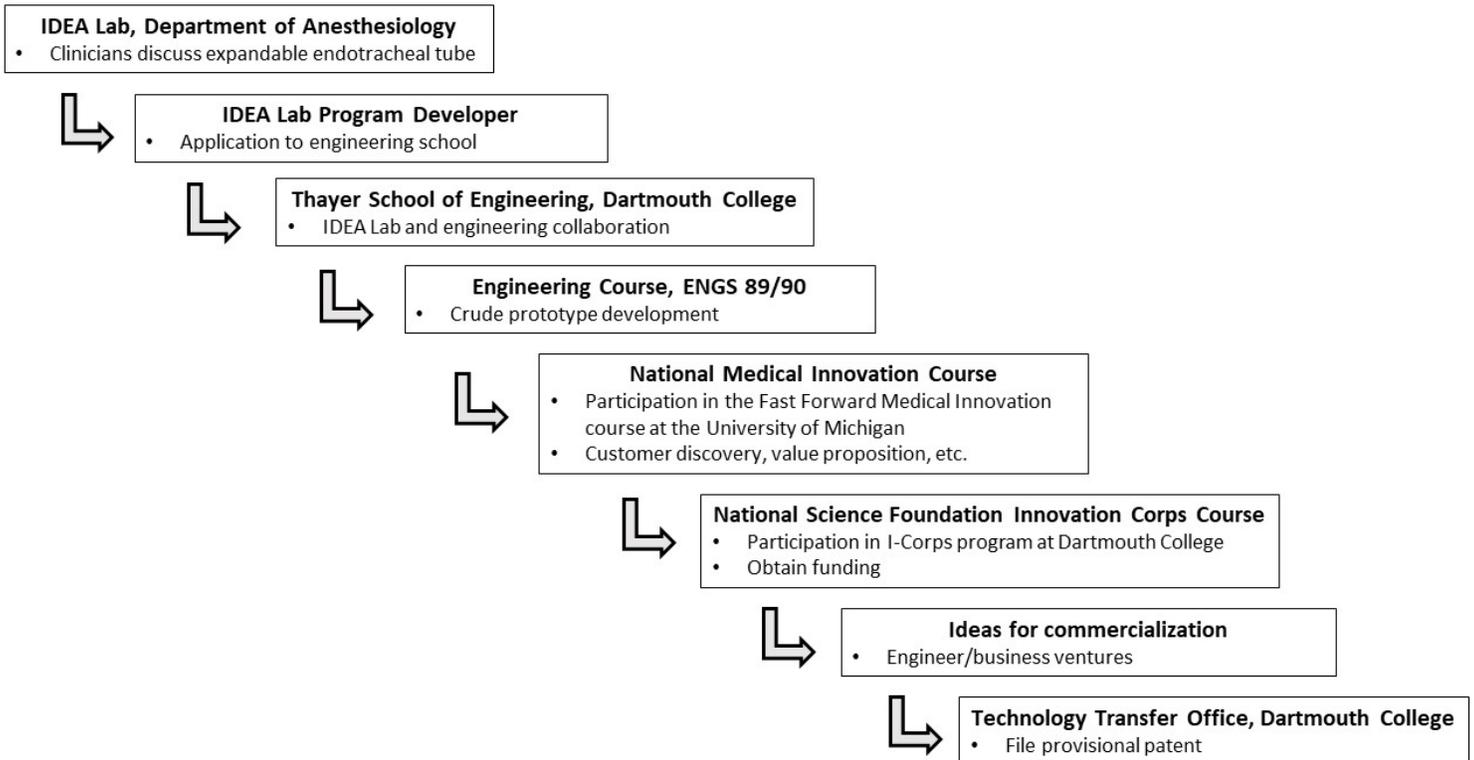
Introduction: Fifty million intubations are performed globally each year with over 20 million done in the United States (1). However, different surgical procedures require specialized endotracheal tubes (ETT) with unique characteristics. Anatomic variations in patients as well as oropharyngeal and laryngeal lesions may make placement of a normal sized ETT challenging or impossible. Clinicians may provide solutions to the problems experienced during intubation, but need collaboration with engineers. In order to develop medical devices to solve unique clinical challenges, the development of a program with access and assistance of technical and business expertise is required. We present our experience and the pathway used by the Dartmouth Health Innovation Development and Entrepreneurship in Anesthesia (IDEA) Lab in the development of an expandable ETT.

Methods: In the spring of 2021, we identified a clinical problem experienced by many anesthesiologists when placing a normal sized ETT in patients undergoing dental and ENT surgeries: placement can be very difficult. The idea to develop an expandable ETT was formalized into a written proposal and presented to engineers (ENGS 89/90) at the Thayer School of Engineering at Dartmouth College. Clinicians, the IDEA Lab program developer and engineers collaborated (Fall 2021-Spring 2022) on the device’s mechanical and structural feasibility and developed a crude prototype. IDEA Lab members enrolled in medical innovation courses at The University of Michigan (Fast Forward Medical Innovation) and at Dartmouth College (I-Corps program). Both were focused on product development, commercialization and regulatory pathways. We filed a United States provisional patent via the Technology Transfer Office at Dartmouth College.

Results: The IDEA Lab developed a device development pathway, from ideation and to a provisional patent (Figure 1). On October 18, 2022 we successfully filed a provisional patent for “An expandable endotracheal tube and method for use of same”. Our expandable ETT’s reduced outer diameter has the potential to be used for all intubations.

Conclusion: We highlight the pathway used by the Dartmouth Health IDEA Lab in the development of the idea for an expandable ETT to a provisional patent. Technical challenges were solved in collaboration with engineers, and business challenges were discussed and learned from national and NSF based medical innovation courses and programs. The IDEA Lab pathway is currently being used for numerous other projects, with the goal of future commercialization of such devices.

Figure 1. Device development pathway for an expandable endotracheal tube.



References:

1. Grand View Research. Endotracheal Tube Market Size, Share & Trend Analysis Report by Product Type (Regular Endotracheal Tube, Reinforced Endotracheal Tube), By Route, By Application, By End-use, By Region, And Segment Forecasts, 2021-2028. 2022.