

A Novel Digital 3D Printed Cricoid Pressure Device

Presenting Author: Michael Dinsmore BSc, PhD, MD, FRCPC, Assistant Professor, Department of Anesthesia, University of Toronto

Co-Authors: Sachin Doshi, Medical Student, University of Toronto, Mandeep Singh, Assistant Professor, Department of Anesthesia, University of Toronto

Introduction: The application of cricoid pressure is a widely adopted, yet controversial component of RSI^{1,2}. One major component of the controversy is the inability to apply and maintain the correct force. Too little force is ineffective at preventing gastric regurgitation and too much force may restrict ventilation and worsen views during laryngoscopy². Therefore, the objective was to develop a customizable, 3D printed device capable of applying an accurate and reproducible force.

Materials and Methods: The device contains a compression/tension micro load cell (model: TAS520-5kg HT Sensor Technology Co. Ltd.) that is incorporated into a 3D printed cricoid pressure application system (Figure 1). It is designed for testing forces in the range of 0-5 kg (~50 N). The load cell system is calibrated using scientific grade calibration weights. The load cell system is then attached to an Arduino circuit board, HX711 load cell amplification circuit and LCD digital display that are all encased in a 3D printed enclosure. The system can either be directly attached to a computer via USB in order to capture and analyze all of the data or conversely with a 9V battery to give improved portability. In either case, the Force (N) is displayed on the LCD screen to give the user the exact force being applied in real time.

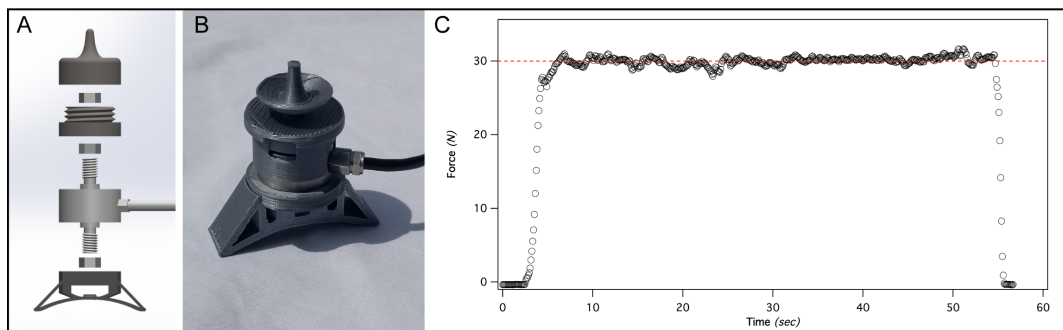


Figure 1. A) Schematic representation of tension/compression load cell embedded in a 3D printed system B) Prototype Version 1 C) A single experiment showing cricoid pressure on a model maintained at 30 N over 1 min duration using the 3D printed cricoid pressure device.

Conclusion: We have developed an ideal cricoid pressure device that is capable of reliably producing accurate forces. In addition, it has detachable custom blades that are both disposable and can be printed to fit a variety of patients of various ages and anatomical differences.

References:

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2. Salem MR, Khorasani A, Zeidan A, Crystal GJ. Cricoid Pressure Controversies: Narrative Review. *Anesthesiology.* 2017;126(4):738-752.