

A better way to open an airway

December 3 2015, by Matt Schutte

We've all seen the procedure on medical drama television shows. A patient is critically injured or ill, and paramedics, nurses or doctors need to open their airway quickly. The delicate procedure is called intubation and it's most commonly performed using a tool called a laryngoscope.

With nearly 25 million intubations performed each year in the U.S., and at least 1 percent ending in failure, there is a pressing need for improved technology. So a team of Ohio State engineers began working with Dr. Hamdy Awad, an anesthesiologist at The Ohio State University Wexner Medical Center and associate professor in the College of Medicine.

In addition to emergencies, patients need intubation when under general anesthesia to maintain an open airway during surgery.

Mechanical Engineering Professor Emeritus Bob Bailey met Dr. Awad through a mutual friend in Spring 2013.

Robotic intubation device in development at The Ohio State University

"Hamdy shared the difficulty he experiences in some of the intubations he performs," Bailey recalled, "and I suggested that with machine vision and automatic controls being what they are today, it is not out of the question that a robotic device could more accurately perform intubations than a human."

A laryngoscope—invented in the late 19th century—or other intubation

tools currently available require human visual guidance. According to Awad, medical professionals often are unable to see important parts of airway anatomy because of the presence of blood, vomit, swellings, and lesions.

"During intubation, it is critical to locate or identify the vocal cords so that the breathing tube passes between them into the trachea instead of into the esophagus," he added.

Encouraged by common interest and motivated by a healthcare problem in need of a solution, Bailey and Awad formed an interdisciplinary team including engineers, industrial designers, students, physicians, and Ohio State's Technology Commercialization Office, which recently helped the inventors file a patent application.

The team set out to develop a robot that would intubate patients with greater accuracy by using more than human vision as a guide, thereby reducing or eliminating the number of failures and other problems in airway management. An autonomous device also increases the likelihood that first responders and military personnel could intubate during medical emergencies.

Having just completed proof of concept testing, their robotic endoscopic device is propelled by an electric motor and controlled by a small computer. The device receives three-dimensional information about its anatomical location by means of a small speaker placed on the skin near the patient's laryngeal prominence—Adam's apple—emitting sound and magnetic waves detected by accelerometers and magnetic fields, respectively.

The development team includes Mechanical Engineering Associate Professor Tony Luscher, who has advised three teams of senior capstone teams working on the device, and Engineering Laboratory Supervisor

Joe West, who has been instrumental in prototyping and testing. A group of students from Ohio State's Technology Entrepreneurship and Commercialization Institute and its leader, Michael Camp, have provided business guidance.

Outside of Ohio State, Carnegie Mellon University Chair of Industrial Design Wayne Chung and P&C Pharma President and COO Mike Sieron have contributed time and expertise to the effort.

The next team member Bailey and Awad need to recruit is an individual or corporate partner to help fund development.

"The progress made by this diverse team is extraordinary," said Bailey. "Our next steps include refining computer software, optimizing the motor and embarking on human tests. That is going to take some money, but I think the potential benefit of this technology makes it a great investment."

Provided by The Ohio State University

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