

# Tracheoesophageal Prosthesis Insufflator

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Advanced Computer Integrated Surgery 2013

## Introduction

--Patients who undergo total laryngectomy will have their larynx removed and lose their ability to speak. After surgery, they are fitted and trained with a voice prosthesis, the most popular being the tracheoesophageal voice prosthesis (TEP).

--A TEP is a one-way valve that redirects air from the trachea to the esophagus, and the patient produces sound waves via esophageal vibrations.

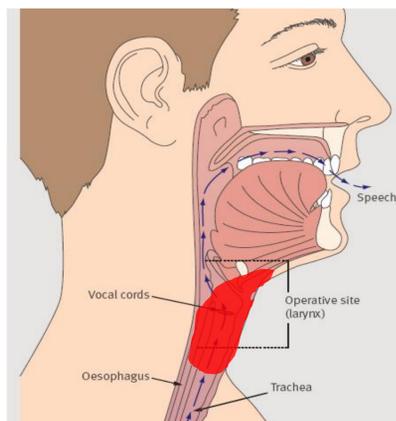


Fig. 1 Site of laryngectomy in red

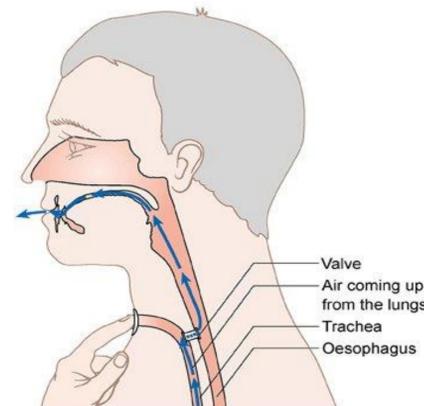


Fig. 2 TEP operation

-- Operating the TEP requires constant obstruction of the stoma with a finger, which is inconvenient. Those with arthritis, poor coordination, or weak pulmonary reserves are at a disadvantage as well.

-- An insufflator connects directly to the TEP and drives air through the TEP at the user's discretion, increasing convenience. User can still breathe with insufflator connected.

Figure 1 image from drugline.org

Figure 2 image from Cancer Research UK.org

## Acknowledgements

- Thanks to Niel Leon for assistance in 3D printing.
- Thanks to Nishikant Deshmukh for assistance in the course.

## Results



Fig. 1 TEP with connector



Fig. 2 Pressure regulator valve



Fig. 3 CO<sub>2</sub> receiver

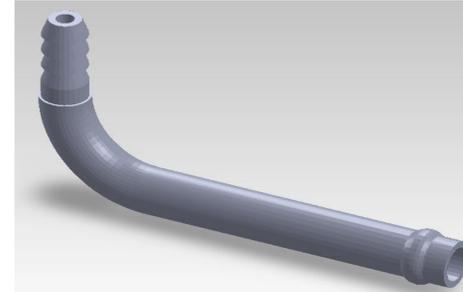


Fig. 4 TEP connector



Fig. 5 Quick-Detach in PTC Creo

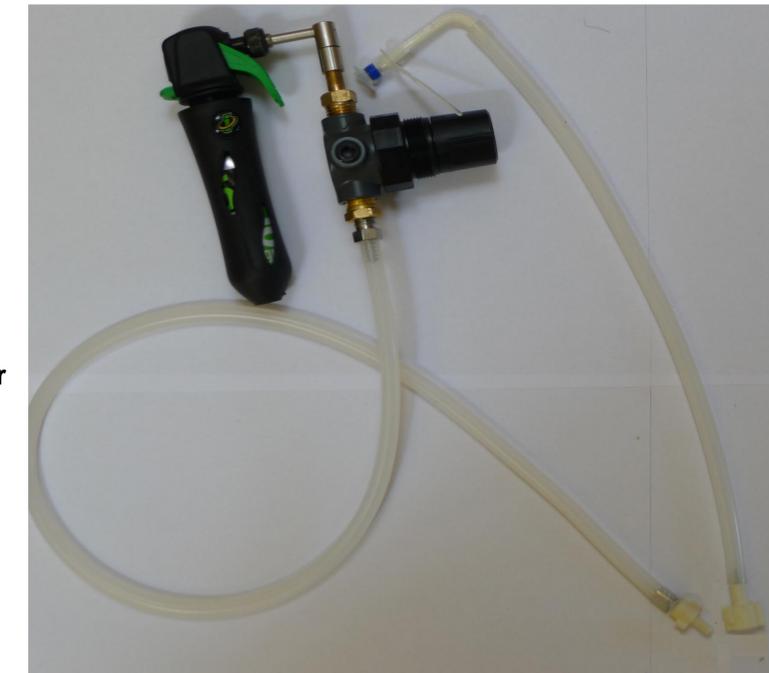


Fig. 6 Insufflator

## Methods

--16 gram CO<sub>2</sub> cartridges are fed into a trigger-activated receiver. Cartridges are threaded for fast and secure replacement. Trigger block lever discourages accidental discharge.

--Pressure regulator valve reduces air pressure leaving CO<sub>2</sub> cartridges to a suitable pressure for TEP operation. The user can adjust the pressure to suit his or her own use.

-- User can dismantle quick-detach system should the pressure regulator fail during use.

-- TEP right-angle connector interfaces with TEP to remain plugged in the bore but can be easily removed or inserted. Part is 3D-printed to fit the specific TEP bore diameters.

## Conclusions

--Insufflator is capable of delivering low pressure air to the TEP (rated at 0.142-0.284 PSI, maximum 0.569 PSI). Due to 0-5 PSI output range of valve, adjustment is feasible but requires very minute turns.

--Small size of CO<sub>2</sub> cartridges leads to frequent changes. Other CO<sub>2</sub> cartridges and canister sizes are available, but choosing will be a balance between portability and endurance.

--Future designs would include a custom 0-1 PSI adjustable regulator valve and a hands-free air release system. Future work includes testing with actual TEP patients and streamlining the design for patenting.

-- Speech rehabilitation is no longer about simply restoring speech. Restoring the convenience and the aesthetics of the human voice is equally as important.