Del Playa Medical – Laryngoscope with Integrated Suction
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Winning Device of 2006 UCSB Business Plan Competition - Patent Pending

Abstract
There is a very real problem with a current trauma procedure. Endotracheal Intubation is the process of placing a tube in the windpipe for ventilation of an unconscious, not breathing patient. A laryngoscope is used to perform this life saving procedure. If there are bodily fluids in the throat, the laryngoscope must be removed and a secondary suction device used before intubation can be attempted. This wastes valuable time and can result in brain damage or death. We have solved this problem by designing a laryngoscope with the functionality of a suction system. This has the potential to increase efficiency and success rates of intubation, and most importantly save lives.

Engineering Requirements
- Suction must meet benchmarks
- Must not hinder user’s mobility
- All components must be lightweight and fit inside handle
- Must satisfy FDA regulations and cleaning requirements
- Must be dependable and safe

Solution and Technology
- LED light used to minimize battery size required
- Suction generated using Bernoulli Principle
- CO2 cartridge provides compressed air
- Trigger activated suction
- Disposable bag collects debris
- Suction hose attached to blade

Research
- Patent Search
  - Device is novel, useful, non-obvious
  - No existing patents on technology
- FDA Regulations
  - Laryngoscope is Class I device
  - No 510K

Market Analysis
Annual US Sales of $590 Million
- Laryngoscopes: $460 M
- Suction Devices: $50 M
- Disposable Cartridges: $80 M
- 7,600 hospitals in US
- 45,000 ambulances in US
- 75,000 fire department-based vehicles in US
- Potential replacement market $2.9 billion
- Laryngoscope lifespan: 5 Years

Future Improvements
- Design inline trigger and valve to minimize size
- Use custom compressed air/nitrogen canisters to eliminate freezing and increase pressure
- Place internal parts into replaceable cartridge
- Design protective casing for battery
- Install one-way valve as safety against backflow
- Develop disposable bag system

Challenges Encountered
- Find a lightweight, and powerful way to produce suction.
- Bernoulli devices require large volumes of gas at high velocities to meet benchmarks.
- Design and manufacture Venturi Chambers that have the highest evacuation rate per volume of compressed air.
- Fit all components into handle.
- Gas canister freezes due to large pressure drop causing the CO2 to change state from a gas to a liquid resulting in a loss of flow, hindering suction.

Test Data
- Max Flow Rate: 10.72 mL/s with 25g Cartridge
- Max Volume: 96 mL in 15 seconds with 40g Cartridge

Figure 1: Intubation Process

Figure 2. Prototype (left) SolidWorks (center) exploded view (right).

Figure 2. Prototype (left) SolidWorks (center) exploded view (right).

Figure 3. Comparison of flow rates (left) and volumes (right).

Complications
- Can not see airway while suctioning
- Multiple attempts often required
- 2 rescuers may be required
- Time is wasted switching devices
- Failure results in brain damage or death

Benchmarks
- Min Flow Rate Necessary: 4-6 mL/s
- Min Volume of Evacuated Debris: 60 mL
- Max Duration of Suction: 15 seconds
- Max Vacuum Pressure: 550 mmHg
- Mechanical suction device evacuates 33 mL/s
- V-Vac evacuates 75 mL/s

Acknowledgments
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References
www.uspto.gov
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