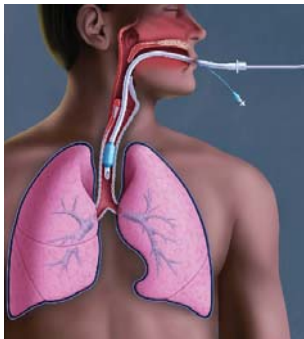
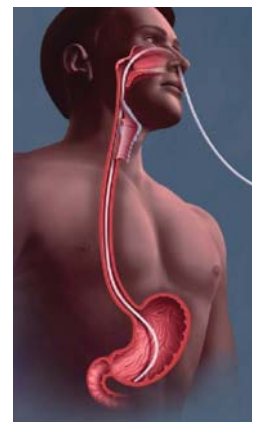


# Avoiding the Hazards of Inadvertent Administration of High Suction Pressures



Tracheal



Nasogastric

There are **two key aspects** of clinical suctioning that are most commonly overlooked which could lead to over-suctioning and various clinical complications:

# 1 Choosing the appropriate suction pressure:

## Recommended Guidelines for setting Suction Pressures

### Endotracheal [14]\*

Adults	-100 to -140 mmHg
Pediatrics	-80 to -100 mmHg
Infants	-60 to -80 mmHg

### Nasogastric drainage [15]\*

Adult:	-20 to -80 mmHg (Intermittent)
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Always follow your institutions recommended guidelines for clinical suctioning.

# 2 Setting the suction pressure correctly:

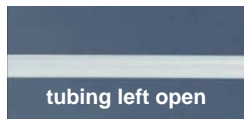
## Always Occlude-To-Set for proper suction levels

In order to properly set the maximum pressure, the flow path must be fully occluded.

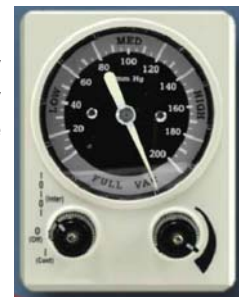


**If not occluded..... and/or not properly set.....**

If the flow path is not occluded, the pressure setting will be too high.



When this happens the clinician inadvertently sets the minimum vacuum pressure and may expose the patient to high suction pressure that may cause harm to the patient during suctioning.



**The results could be.....**

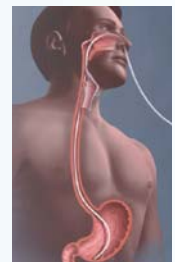
**inadvertent high suction pressures.  
Hazards during suctioning are as follows:**

### During tracheal suctioning:



- Hypoxia/Hypoxemia [1,2,4,5,6,7,8,10,11]\*
- Atelectasis [2,5,8]\*
- Mucosal tissue tears [5,9,13]\*
- Bleeding [5,9,13]\*
- Increased risk of infection [3,5,12]\*

### During nasogastric suctioning:



- Mucosal tissue tears [5,9,13]\*
- Bleeding [5,9,13]\*
- Increased risk of infection [3,5,12]\*

Are your **Vacuum Regulators** helping you to avoid over suctioning ?

**OHIO MEDICAL'S Push-To-Set™ Technology is an integrated passive safety system designed to prevent inadvertent over-suctioning.**



One Simple, One Handed Step

## THE TECHNOLOGY:

When the vacuum adjustment knob is depressed, the vacuum flow path is “automatically occluded” and will accurately reflect maximum suction pressure.

Because the patented PTS technology occludes the flow path when the knob is depressed, the clinician is not required to occlude the flow path to set maximum pressure.

## DID YOU KNOW.....



- ✓ Push-To-Set™ technology enhances setting safe suction pressures through automatic occlusion.
- ✓ Digital technology enhances display of accurate suction pressure ( $\pm 1\%$ ) providing unsurpassed safety.

# Educational Tools

## Enhancing the Safety of Medical Suction Through Innovative Technology

Patricia Carroll, RN, BC, CEN, RRT, MS

**Abstract:** Medical suctioning is essential for patient care. However, few clinicians receive training on the principles of physics that govern the safe use of medical suction. While all eight manufacturers of vacuum regulators sold in North America require occlusion of the tube before setting or changing vacuum levels, anecdotal evidence reveals that clinicians are not aware of this requirement or skip this step when pressed for time. This white paper summarizes the physics relating to medical suction, the consequences of damaged mucosa, the risks to patient safety when suction levels are not properly set and regulated, and technology advances that enhance patient safety.

Medical suction is an essential part of clinical practice. Since the 1920s, it has been used to empty the stomach, and in the 1950s, airway suction levels were first regulated for safety. Today, medical suction is used for newly born babies and seniors, and in patients weighing between 500 grams and 500 pounds. Medical suction clears the airway, empties the stomach, decompresses the chest, and keeps the operative field clear. It is essential that clinicians have reliable equipment that is accurate and easy to use.

### Why a Safety Mindset is Important

The current focus on patient safety extends to suction procedures and routines. When suction pressures are too high, mucosal damage occurs, both in the airway<sup>1</sup> and in the chest. If too much negative pressure is applied through a chest tube, lung tissue can be drawn into the eyelets of the thoracic catheter.<sup>2</sup> Researchers are examining the connection between airway mucosal damage and ventilator-associated pneumonia. In pediatrics, airway suction catheters are inserted to a pre-measured length that avoids letting the suction catheter come in contact with the tracheal mucosa distal to the endotracheal tube.<sup>3</sup> Mucosal damage can also be mitigated with appropriate suction techniques, and every effort should be made to reduce this threat to the immune system of patients who are already compromised. Damaged airway mucosa releases nutrients that support bacterial growth<sup>4</sup>, and P. pneumoniae and other organisms are drawn to damaged epithelium.<sup>5</sup> Mucosal damage in the stomach can result in bleeding and ascites as well as formation of scar tissue.

### Physics of Suction

Flow rate is the term used to describe how fast air, fluid, or

secretions are removed from the patient. Ideally, clinicians need the best flow rate out of a vacuum system at the lowest negative pressure. Three main factors affect the flow rate of a suction system:

- The amount of negative pressure (vacuum)
- The resistance of the suction system
- The viscosity of the matter being removed

The negative pressure used establishes the pressure gradient that will move air, fluid, or secretions. Material will move from an area of higher pressure in the patient to an area of lower pressure in the suction apparatus. The resistance of the system is determined primarily by the most narrow part of the system — typically, a tubing connector — but the length of tubing in the system can increase resistance as well. Watery fluids such as blood will move through the suction system much more quickly than thick substances such as sputum. At one time, it was thought that instilling normal saline into an artificial airway would thin secretions, enhancing the flow of secretions out of the airway. However, research shows that thinning occurs and that patients' oxygenation drops with saline installation. Thus, the practice should be abandoned.<sup>6, 7</sup>

Increasing the internal diameter of suction tubing or catheters will increase flow better than increasing the negative pressure or shortening the length of the tube. However, in most clinical applications the size of the patient will be the key factor determining the size of the catheter that can be safely used. Researchers at the Madigan Army Medical Center explored factors affecting evacuation of the oropharynx for emergency airway management. They tested three substances — 90 mL of water, activated charcoal, and Progresso vegetable soup — with three different suction systems, progressing from a standard 0.25-inch internal diameter to a 0.625-inch internal diameter at its most restrictive point. All systems evacuated water in three seconds. The larger diameter tubing removed the soup 10 seconds faster and the charcoal mixture 40 seconds faster than the traditional systems. The researchers note that this advantage in removing particulate material can speed airway management and reduce the risk or minimize the complications from aspiration.<sup>8, 9, 11</sup>

### Occlude to Set for Safety

Vacuum regulators are ever-present in the hospital setting. Clinicians use them daily and may not be as attentive to this

Reference Neonatal Intensive Care, May-June 2008 Issue, Article: Enhancing the safety of Medical Suction Through Innovative Technology, by Patricia Carroll, RN, BC, CEN, RRT, MS



## Video 1: Clinical Animation Video "Avoiding the Hazards of Inadvertent Administration of High Suction Pressures"

## Video 2: Clinical Video "Understanding the Hazards of Tracheal Oversuctioning"

## The Principles of Vacuum and Its use in the Hospital Environment

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