THERAPY SOLUTION

# F&P Optiflow™

## Comfortable, Effective Oxygen Therapy for Tracheostomies




Fisher & Paykel HEALTHCARE

# World-leading respiratory technology

Tracheostomy High Flow is delivered using Fisher & Paykel Healthcare's

## F&P Optiflow™ system with Optiflow™ Tracheostomy Interfaces

### The F&P Optiflow System

This proprietary system has been designed to work with a wide variety of flow sources including ventilators and traditional air/oxygen blenders, giving caregivers the flexibility to use familiar equipment. Dual feedback control of the F&P 850 System ensures a consistent temperature and humidity level is delivered across the entire therapy flow range up to 60 L/min at 21 to 100% oxygen while the comfortable, easy-to-fit cannula requires minimal input from caregivers.

F&P Optiflow is unmatched in terms of humidity performance and patient tolerance to therapy.

### DELIVERING TRACHEOSTOMY HIGH FLOW

F&P Optiflow™

PLATFORM

FLOW SOURCE
**Air/$O_2$ Blender**

HUMIDIFIER
**MR850**

DELIVERY SYSTEM

HUMIDIFICATION CHAMBER + BREATHING CIRCUIT
**RT202***

INTERFACE

F&P Optiflow™

** The RT202 kit includes an MR290 humidification chamber*

# Humidification for tracheostomies

Bypassing the upper airway produces a detrimental humidity deficit in the airways. This causes a range of complications from thick secretions, loss of ciliary action, deterioration of pulmonary function and an increased risk of infection.[1,2]

In the intensive care unit, humidification of the bypassed airway is a standard of care,[3] while for the longer-term patient the requirements are less clear. Data from reports for both children and adults shows that providing optimal humidification (gas conditioned to 37 °C and 100% Relative Humidity) to patients with chronic tracheostomies results in a reduction in secretion volume, suctioning frequency and tracheostomy tube changes, thereby improving atelectasis and quality of life.[1,4]

## BYPASSING THE UPPER AIRWAY

A tracheostomy is a surgical opening in the anterior wall of the trachea (tracheal stoma) made with the aim of facilitating ventilation. A tracheostomy tube is used to maintain the tracheal stoma.

A tracheostomy can be either temporary or permanent. In contrast, a total laryngectomy is permanent as it involves the complete removal of the larynx (voice box). The remaining end of the trachea is then sewn into an opening in the neck (an end tracheostomy). This means that the lungs are permanently disconnected from the mouth and nose, and are only connected to the tracheal stoma in the patient's neck, see Figure 1.

Both a tracheostomy and a laryngectomy result in respiration bypassing the upper airway (i.e. nose, oropharynx and trachea) and they prevent the normal addition of heat and moisture to inspired air by the upper airway.

Typically, the upper airway contributes 75% of the heat and moisture that is added to inhaled air.[5] The upper airway also recovers heat and moisture during exhalation.

Bypassing these warming and humidifying functions exposes the carina to cooler, drier gases than normal. This humidity deficit causes a range of difficulties from thick secretions and tracheostomy tube blockages[6] through to cilial dysfunction and death,[7] with resulting impaired mucociliary clearance.

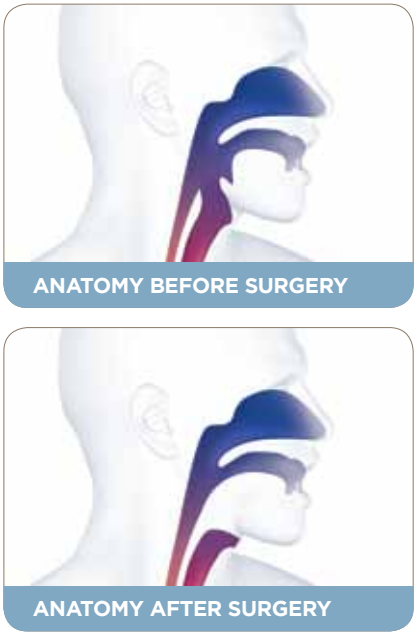



Figure 1: Altered anatomy following laryngectomy

# Complications due to a lack of humidification

Early complications of tracheostomy associated with poor humidification include thick, dry, tenacious secretions and tracheostomy tube occlusion.[6]

A prospective, randomized controlled study in intensive-care patients reported six episodes of tracheostomy tube occlusion in 31 patients using a HME while no patients receiving humidification via a heated humidifier with a heated wire circuit experienced this complication ($p<0.01$).[6]

Late complications and sequelae associated with poor humidification are listed in Table 1 below. It is important to note the impact of respiratory symptoms (such as frequent stoma cleaning and coughing) on the level of fatigue, sleep problems, social contact and psychological distress experienced by the patient with a chronic tracheostomy.[8]

Long-term complications are more frequent than early onset complications with rates ranging from 46 to 63%, with the most frequently reported being the development of granulation tissue.[9] This can form as a result of copious secretions and recurrent tracheitis.[10]

**TABLE 1. LATE COMPLICATIONS ASSOCIATED WITH POOR HUMIDIFICATION IN CHRONIC TRACHEOSTOMY[2,6,8,95,11-13]**

- Thick, tenacious, crusted secretions
- Excessive sputum production
- Tracheostomy tube occlusion
- Frequent stoma cleaning
- Frequent forced expectoration
- Coughing
- Difficulty sleeping
- Disrupted social contact
- Poor voice quality
- Poor quality of life/psychological distress
- Irritated and/or damaged airway mucosa
- Bleeding
- Local infection (due to damaged mucosal barriers)
- Pulmonary infection (due to impaired mucociliary clearance)
- Cellular desquamation
- Loss of ciliary action
- Formation of granulation tissue
- Impaired pulmonary function

## DOESN'T THE AIRWAY ADAPT?

The trachea is an inefficient humidifier when compared to the nose[4] and breathing through a stoma results in 500 mL of extra water loss daily.[8] Compared to the nose, the surface area of the trachea is smaller, air-flow is less turbulent and the tracheal mucosa does not contain effective arteriovenous anastomoses, making it more vulnerable to cooling.[14] In the nasal mucosa a rich blood supply and the close proximity of arteries and veins allow considerable heat exchange to occur. When the temperature drops, the vascular plexus becomes engorged, enhancing the gas conditioning process. These differences in vasculature give the nasal mucosa a far greater ability to cope with a reduction in inspired temperature and humidity than the trachea and also allow for greater recovery of heat and moisture on exhalation.

# Methods to deliver humidity

"Both an endotracheal tube and a tracheostomy tube have the same effect of bypassing the upper airway and preventing normal humidification of inspired gases."[15]

Several different methods can be used to add heat and humidity to inspired air. According to the American Thoracic Society, the most efficient device is a heated humidifier.[2] Two other devices are a nebulizer, which produces a spray of water droplets, and a heat and moisture exchanger (HME).

When comparing these devices it is important to note that Optimal Humidity (gas warmed to 37 °C, 44 mg/L Absolute Humidity, 100% Relative Humidity) can only be delivered by heated humidifiers.

HMEs typically deliver between 17 and 32 mg/L16 Absolute Humidity with moisture output varying between different HMEs. Conditions such as ambient temperature and tidal volume also influence HME moisture output.

Heated humidifiers produce the most appropriate type of supplemental humidity, namely water vapor (particle size approximately 0.0001 micron) rather than water droplets (particle size approximately 1 to 40 microns, within the range suitable for pathogen transport) which increases the risk of infection.[17]

Particulate water, such as that produced by a nebulizer, can cause obstruction of the terminal airways as a result of water accumulation.[18] The resulting over-humidification is due to the large particle size and can not occur with molecular water vapor delivered at body temperature.

**Methods to deliver humidity**

| | |
|---|---|
| 1 | **HEATED HUMIDIFIER**<br>• Most efficient<br>• Can deliver Optimal Humidity 37 °C, 44 mg/L Absolute Humidity |
| 2 | **NEBULIZER**<br>• Delivers droplets of water |
| 3 | **HEAT & MOISTURE EXCHANGER (HME)**<br>• Delivers 17 to 32 mg/L Absolute Humidity |

**FACTORS INCREASING THE NEED FOR HUMIDIFICATION**

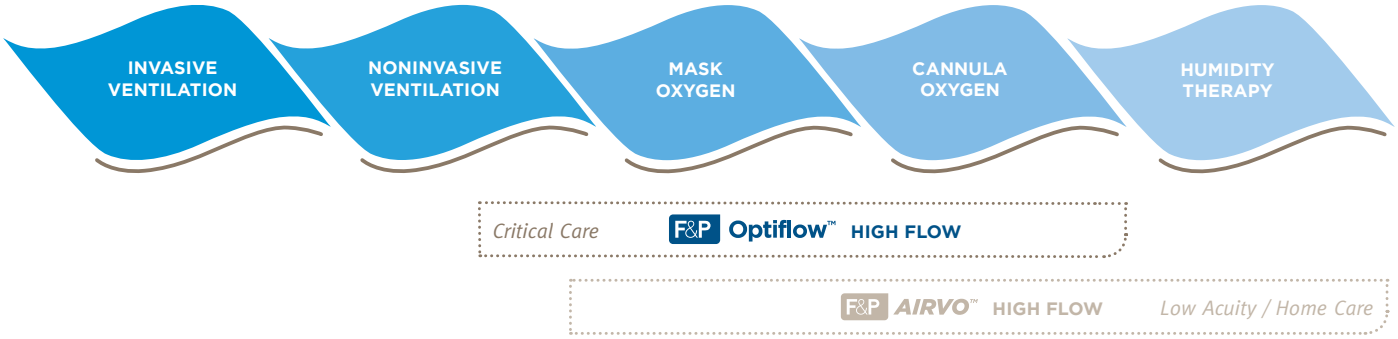
- Children/neonates are especially susceptible to heat and moisture loss; tracheal obstruction is more critical with smaller airways
- Supplemental oxygen
- Concurrent radiotherapy
- Frequent suctioning (excessive use may cause bleeding)
- Dry environment (air conditioning, especially in colder climates during winter)
- Impaired cough or unable to generate cough e.g. neuromuscular disease
- Excessive sputum production (first year post-surgery, chronic respiratory disease, respiratory infection)

# Susceptible patients

Children are at a greater risk of the effects of thickened secretions due to their small-caliber airways and small tracheostomy size.[1] Given this, there is a general consensus supporting supplemental heat and humidification in the hospital as well as at home.[19]

There are other times when there is an increased need for humidification. This may be as a result of factors that increase airway drying or due to patient factors associated with decreased tolerance for low humidity.

# Superior science and care




**F&P Adult Respiratory Care Continuum™** Fisher & Paykel Healthcare is committed to advancing our capabilities as a world leader in humidified therapy systems with a comprehensive family of solutions that restore natural balance. We call this our F&P Adult Respiratory Care Continuum. There are many therapies for treating spontaneously-breathing patients. Optiflow and AIRVO are new alternatives designed to improve care and outcomes for these patients. Optiflow works with independent flow sources and is intended for Critical and Acute Care environments. AIRVO is an integrated humidifier and flow source designed for lower acuity environments including the home.

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