

Aerosol generation with High Flow Nasal Cannula (HFNC) and Non-invasive Ventilation (NIV) Whitepaper

ReddyPort™ non-invasive ventilation products

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Introduction

Respiratory failure is a common presentation at hospitalization for patients with coronavirus disease (COVID-19) pneumonia. Treatment involves respiratory support, often with high flow nasal cannula, non-invasive ventilation (NIV) or mechanical ventilation. The risk of transmission of the virus by aerosolized particles from patients to health care providers is a major concern that has dominated the decision-making process. Early intubation and mechanical ventilation has been suggested due to concern that high flow nasal cannula or NIV may result in higher aerosol generation and viral transmission. However, there is no clear evidence to support that high flow nasal cannula or NIV generate higher levels of aerosolized respiratory secretions. In simulator models, high flow nasal cannula and NIV dispersed aerosol further than nasal cannula or face mask.^{1,2} Conversely, in healthy volunteers, oxygen delivery via high flow nasal cannula or NIV was shown to not increase aerosol generation.³ Cough has been shown to generate aerosols that travel farther in simulations,⁴ but this has not been confirmed in patients. In order to understand the risk of aerosol generation during oxygen delivery, we quantified aerosol particles in hospitalized patients with COVID-19 pneumonia who were being treated with high flow nasal cannula and NIV. We also measured the particle concentration while receiving oral care through ReddyPort™ Elbow while on NIV.

Methods:

Six patients admitted with respiratory failure from COVID-19 pneumonia and requiring intermittent high flow nasal cannula and NIV were evaluated. Aerosol measurements were performed using a Grimm 1.109 Aerosol Spectrometer (*Grimm Aerosol Technik, Ainring, Germany*) with the sample sensor placed 3 feet away from the patient's head, facing the patient's oral cavity. Concentration of aerosol particles between 0.225 μm and 34 μm was measured every 30 seconds. For each patient, aerosol concentration was measured while they received oxygen therapy with the following modalities:

- High flow nasal cannula
- NIV with Philips Respironics AF541 mask and leak 1 elbow
- NIV with Philips Respironics AF541 mask and leak 2 elbow
- NIV with Philips Respironics AF541 mask and leak 1 ReddyPort Elbow

Aerosol concentration was measured for 30 minutes with each modality for each patient and oral care was performed for a minimum of five minutes for each patient while on leak 1 ReddyPort Elbow. The settings for high flow nasal cannula ranged from 35-55 LPM flow and 0.6 to 0.9 FiO_2 . The settings for NIV ranged from 12-25 cm H_2O IPAP, 5-15 cm H_2O EPAP and 0.6 to 1.0 FiO_2 .

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Results:

Although the peak aerosol concentrations were the highest for high flow nasal cannula, the mean aerosol concentrations did not show any significant differences between the various modalities of oxygenation (figures 1-2). Performing oral care through ReddyPort Elbow on NIV mask did not increase aerosol concentration.

Conclusion:

There was no difference in aerosol generation between high flow nasal cannula and NIV in patients with COVID-19 pneumonia. Performing oral care with ReddyPort products did not increase aerosol generation in patients on NIV.

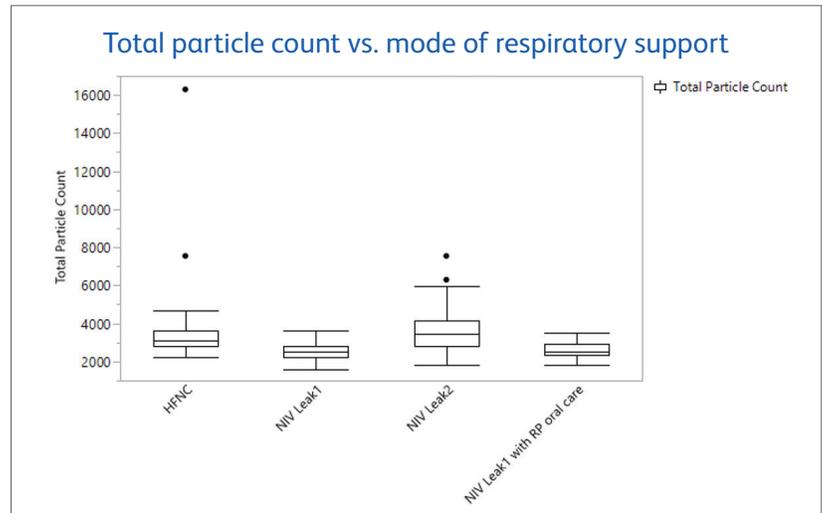


Figure 1

Mode of respiratory support	Mean particle count	Standard deviation	Minimum particle count	Median particle count	Maximum particle count
High flow nasal cannula (HFNC)	3510	1862	2200	3100	16300
NIV Leak 1	2535	465	1600	2525	3650
NIV Leak 2	3571	1064	1800	3450	7550
NIV Leak 1 with ReddyPort oral care appliances	2611	392	1800	2510	3500

Figure 2

For more information call **801.899.3036**.

References:

1 Hui DS, Chan MT, Chow B. Aerosol dispersion during various respiratory therapies: a risk assessment model of nosocomial infection to health care workers. *Hang Kong Med J*. 2014 Aug;20 Suppl 4:9-13. 2 Hui DS, Chow BK, Lo T, Tsang OTY, Ko FW, Ng SS, Gin T, Chan MTV. Exhaled air dispersion during high-flow nasal cannula therapy versus CPAP via different masks. *Eur Respir J*. 2019 Apr 11;253(4):1802339. 3 Gaeckle NT, Lee J, Park Y, Kreykes G, Evans MD, Hogan CJ Jr. Aerosol Generation from the Respiratory Tract with Various Modes of Oxygen Delivery. *Am J Respir Crit Care Med*. 2020 Oct 15;202(8):1115-1124. 4 Loh NW, Tan Y, Taculod J, Gorospe B, Teope AS, Somani J, Tan AYH. The impact of high-flow nasal cannula (HFNC) on coughing distance: implications on its use during the novel coronavirus disease outbreak. *Can J Anaesth*. 2020 Jul;67(7):893-894.

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