COMPARISON OF FIO2 OF NASAL CANNULAS, MASKS, AND MOUTH BITE BLOCK USING IN SEDATION PATIENTS DURING ESOPHAGOGASTRODUODENOSCOPY- A BENCH STUDY

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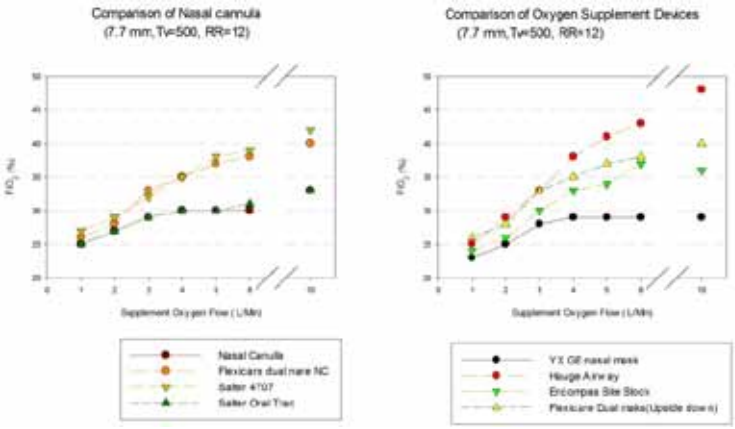
Background: Esophagogastroduodenoscopy (EGD) and colonoscopy procedures are usually performed using conscious sedation [1, 2]. Drug-induced respiratory depression is a major cause of serious adverse effects.Adequate oxygen saturation is very important for patient safety [2]. Keeping the patient at higher oxygen saturation can reduce the severe complications.[2, 3] The oxygen saturation level is affected not only by patient's breathing, but whether supplemental oxygen is being supplied. Supplying the supplemental oxygen to a sedative patient is a common and standard practice[3]. The higher of oxygen saturation before apnea, the longer the patient can tolerate hypoventilation. During the past few years, manufacturers have introduced new models of bite block and nasal cannula that include CO2 sampling ports along with supplemental oxygen delivery. However, the oxygenation ability of these devices has not been evaluated. The current bench test study was designed to compare the FiO2 performance of these new nasal cannulas, masks, and bite block devices which are commonly used during sedation for EGD, colonoscopy and other procedures.

Methods: We connected a mannequin head to one side of a two-compartment test lung model by a 7.0mm endo-tracheal tube with its opening in the nasopharyngeal position. The other lung compartment was driven by a ventilator to mimic "patient" inspiratory effort. In this spontaneously breathing lung model, we evaluated the YX nasal mask (Yong-Xu medical instrument Co., Ltd. Taiwan), The Hauge airway bite block (Penlon, UK), CO25 Bite Block (Encompas Unlimited, Inc., FL), a conventional nasal canula (Adult Nasal Cannula 032-10-020, Flexicare Medical Limited, UK), Flexicare dual nare nasal cannula (Flexicare Medical Limited, UK), a CO2 sampling nasal cannula (Adult Divided cannula 4707-7-7-25, Salter Labs, CA), and an Oral-Trac nasal cannula (Adult Divided Oral/Nasal Cannula 4797, Salter Labs, CA) at various oxygen flow rates and over a range of mouth opening apertures. Note that a Flexicare dual mask (Flexicare Medical Limited, UK) was also tested in an upside down configuration to allow insertion of an upper GI scope. Test lung compliance was set to 50 ml/cm H_2O with a simulated airway resistance of 8.2 cm H_2O/(L*s). Simulated rate and volumes were set at 12 /minute with 500 ml and 8 /minute with 300 ml. Pneuflo resistors in different sizes were applied in the mouth of Manikin head to simulate different levels of mouth opening. FiO_2 was evaluated continually by sampling gas port connected between the from the endotracheal tube and test lung. FiO_2 was measured using an anesthesia gas analyzer (CapnoMAC, Datex, Helsinki, Finland).

Results: FiO_2 was measured using each device with supplemental oxygen flow rates increased from 1 to 6 L/min and at 10 L/min. The amount of FiO_2 increase for each device, oxygen flow rate and breath rate are shown in the figure below. Although the Flexicare dual mask was tested in an upside down method, the results show acceptable performance relative to the other tested devices.

Conclusion: Orifice size of the mouth opening, supplement oxygen flow, tidal volume and respiratory rate all influence the FiO2 in most of the tested devices. Flexicare dual mask in the upside down method has a similar result with other devices that are specially designed for oxygenation during upper GI procedures. This implies that we can use any conventional oxygen delivery mask in this simple method to get the similar effect of supplemental oxygen.



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