**OXYGEN AVAILABILITY DURING HYPOPNEA**

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**Introduction:** Remifentanil has been shown to lead primarily to respiratory depression, while propofol leads primarily to airway obstruction¹. The two drugs are also known to have synergistic effects when dosed together, which leads to combined effects of respiratory depression and airway obstruction. In sedation, bolus administration of drugs is intended to be managed such that the toxic endpoints of respiratory depression and airway obstruction are not reached. We developed a model of SpO₂ during hypopnea and evaluated it during bolus administration of remifentanil and propofol in four animals.

**Methods:** Four male swine (28.9-30.5 kg) were intubated and moderately sedated using a baseline infusion of propofol and remifentanil. Following pre-oxygenation at various F₁O₂ levels, the sedation level was temporarily increased from moderate to deep by means of intermittent boluses of propofol and remifentanil, dosed both individually and together and in addition to the baseline rate delivered by the infusion pump. The bolus volume of each drug was varied to observe differing periods of apnea. The SpO₂ was recorded for later comparison with the model. To simulate sleep apnea (airway obstruction and respiratory depression), a bolus of propofol was delivered in addition to the baseline infusion. Simultaneously, a column of water in a u-shaped, smooth-bore hose was also added to simulate the collapsed tissue of airway obstruction. The column of water was adjusted to different levels, including 4, 8, and 15 cmH₂O of negative inspiratory pressure. To simulate temporary respiratory depression, a bolus of remifentanil was administered. The time difference between the modeled and measured SpO₂ was evaluated for clinically relevant points of 90% and 80% saturation.

*Figure 1: The time difference between actual and modeled SpO₂ at 90% and 80% saturation.*
**Results:** The average period of desaturation for the twenty hypopnea events was 93.3 ± 57.2 sec (range 45-258 sec). The average percentage point change in the SpO₂ was 36.1 ± 22.8% (range 6.3-100%). Figure 1 illustrates the time difference between actual and modeled SpO₂ for 90% and 80% saturation. For SpO₂ of 90%, the average difference between the actual and modeled value was -1.6 ±14.7 sec. For SpO₂ of 80%, the average difference was 1.4±14.3 sec.

**Conclusion:** The modeled changes in SpO₂ compared favorably with the actual timing of desaturation for SpO₂ of both 90 and 80%. Further evaluation of the oxygen availability model is needed in humans.