



# Pooled Oxygen Concentration and Evaluating the Risk of Surgical Fires Using an Intraoral Laboratory Based Model

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## INTRODUCTION

- Surgical oral fires in the operating room continue to be a detrimental occurrence seen with oral surgeries.
- The purpose of this study was to use a laboratory-based model replicating the oral cavity of a 10-year-old to evaluate oxygen pooling values when supplemental oxygen is provided at 3 liters per minute.
- This study also compares efficiency of 1000 PC high speed dental suction tip and the Yankauer surgical suction tip at bringing oxygen concentrations down to safe values.

## FIGURES

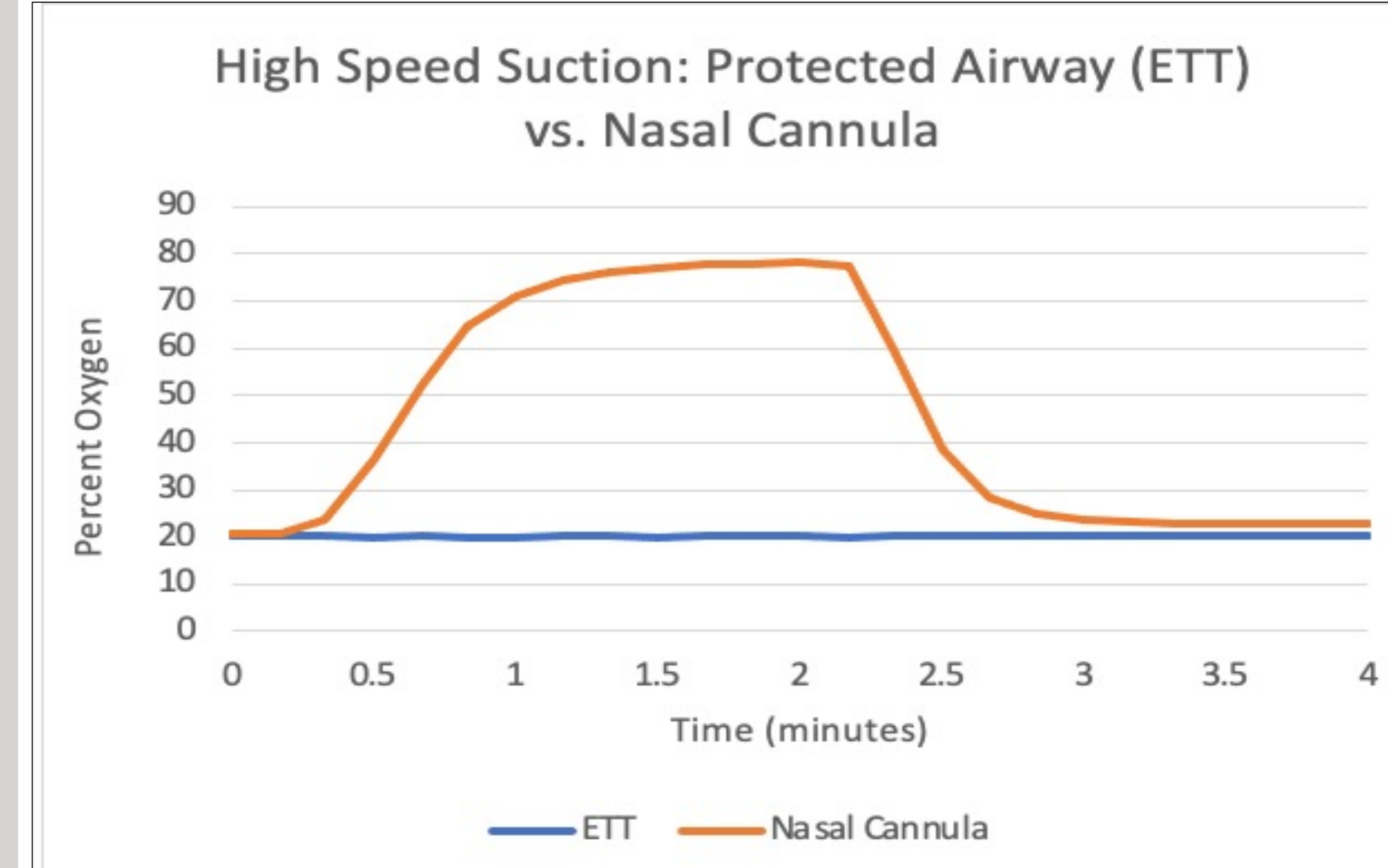


Fig. 2. Oxygen percentage means in trials using the high speed dental suction comparing trials with supplemental oxygen via nasal cannula to trials with no supplemental oxygen simulating a protected airway with endotracheal tube (ETT) intubation.

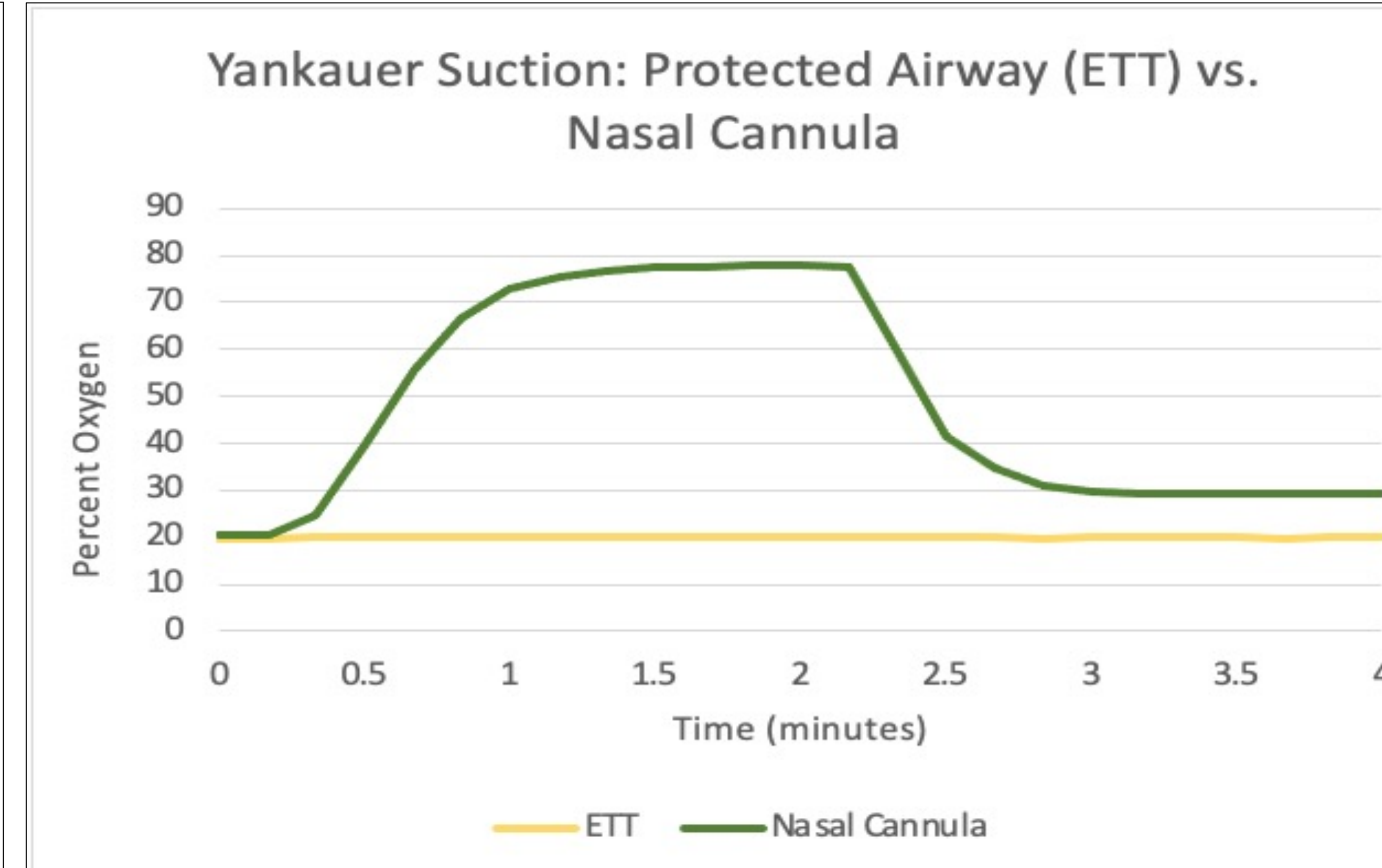


Fig. 2. Oxygen percentage means in trials using the Yankauer surgical suction comparing trials with supplemental oxygen via nasal cannula to trials with no supplemental oxygen simulating a protected airway with endotracheal tube (ETT) intubation.

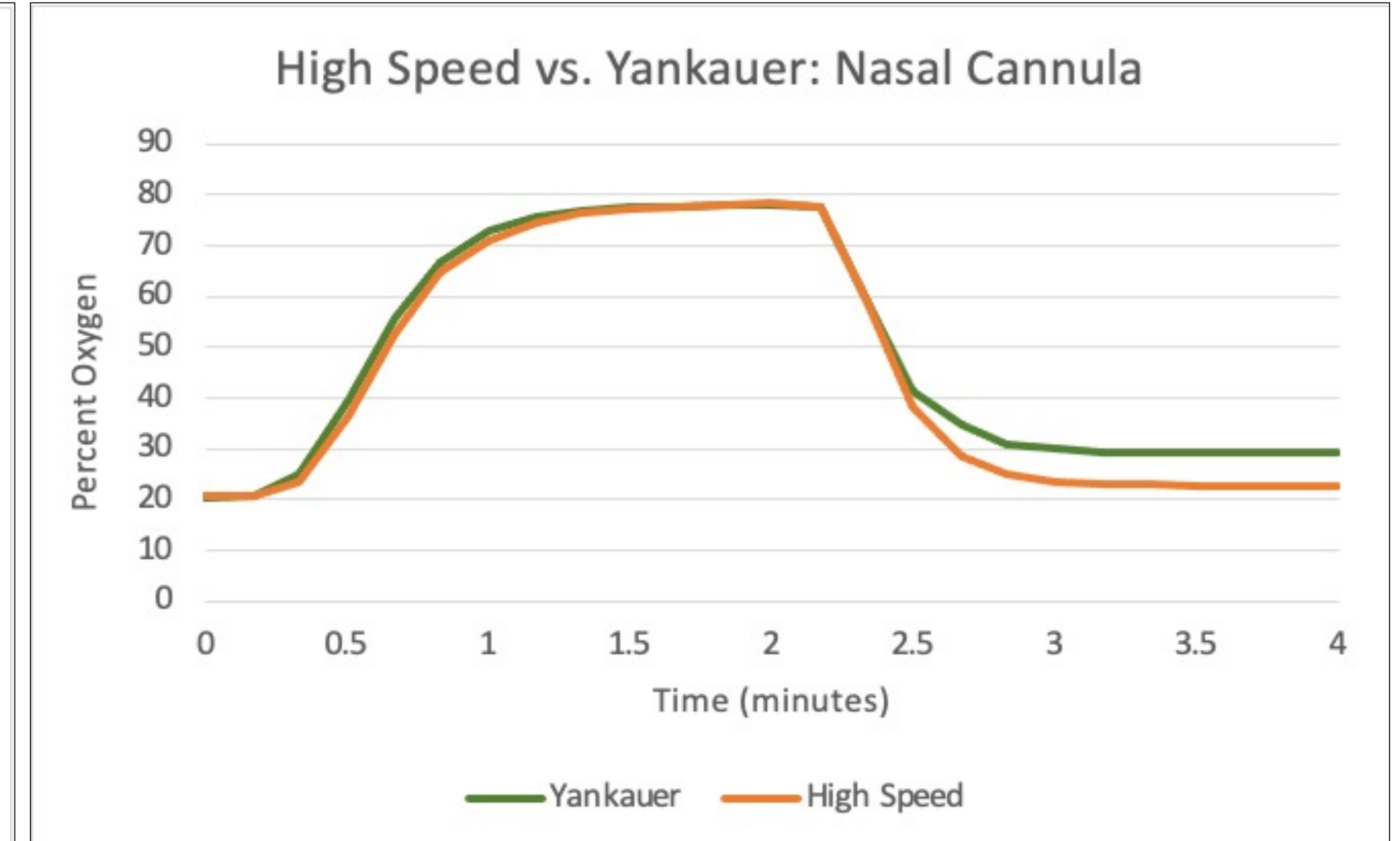


Fig. 3. Oxygen percentage means in trials with supplemental oxygen via nasal cannula comparing trials utilizing high speed dental suction to trials with Yankauer surgical suction. Oxygen measurements with supplemental oxygen via nasal cannula were significantly lower for high speed dental suction than Yankauer surgical suction starting at 2.5 minutes and continuing through the remainder of the times. ( $p < 0.001$ )

## METHODS

An acrylic dome/plastic hemisphere simulated the oral cavity of a 10-year-old. Three different holes were fabricated, representing the oral cavity and both nares. Four data sets with 25 trials each were utilized to collect data: 1. high speed dental suction with supplemental oxygen via nasal cannula representing moderate-deep sedation, 2. high speed dental suction with no supplemental oxygen representing a protected airway with endotracheal intubation, 3. Yankauer surgical suction with supplemental oxygen via nasal cannula representing moderate-deep sedation, 4. Yankauer surgical suction with no supplemental oxygen representing a protected airway with endotracheal intubation. Each trial was four minutes long.

- Supplemental oxygen was provided at 3 L/minute at time zero in trials where supplemental oxygen was given.
- For all trials, no suctioning occurred for the first 2 minutes, but suctioning began at 2 minutes and continued until trial ended at 4 minutes.
- Oxygen concentrations were recorded every 10 seconds for the entire trial.
- 95% confidence intervals were used to estimate the mean oxygen levels at each time point for each of the four groups.
- Repeated measures ANOVA was used to evaluate the effects of time and suction type on oxygen levels separately for trials with and without oxygen supplementation.
- Two-sample t-tests were used to compare the effect of oxygen supplementation by suction type and time.

## RESULTS

- No significant differences between high speed dental and Yankauer surgical suction tips with no supplemental oxygen. ( $p=0.22$ )
- Oxygen measurements were significantly higher with supplemental oxygen than without supplemental oxygen for both suction methods for all time points. ( $p < 0.001$ ) (Figures 1, 2)
- Oxygen measurements with supplemental oxygen were significantly lower for high speed dental suction than Yankauer surgical suction starting at 2.5 minutes and continuing through the remainder of the times. ( $p < 0.001$ ) (Figure 3)
- Oxygen  $> 21\%$  was significantly lower for high speed dental suction than Yankauer surgical suction starting at 3.33 minutes and continuing through the remainder of the times. ( $p=0.022$  at 3.33 minutes and  $p=0.010$  for 3.5, 3.67, 3.83, and 4 minutes)

## DISCUSSION

- We found that oxygen concentration levels in a laboratory-based model of an oral cavity of a 10-year-old can reach flammable and unsafe levels (50% and above) after just 40 seconds when supplemental oxygen is provided at 3 L/minute.
- Oxygen concentrations can near 80% when supplemental oxygen is provided at 3 L/minute just after 2 minutes when no suctioning is present, creating a highly flammable environment.
- The high speed dental suction tip was found to be significantly more efficient than the Yankauer surgical suction tip after 30 seconds of suctioning at bringing oxygen concentration levels closer to room air values. This indicates that the high speed dental suction is likely underutilized in oropharyngeal surgeries.
- Both suction tips brought  $\text{FiO}_2$  mean values below 50% within 0.5 minutes (30 seconds) of suctioning. This indicates that regardless of what type of suction is being used, suctioning is crucial in decreasing oxygen concentrations in an oral surgery environment and therefore crucial in decreasing the risk of oral fires.

## REFERENCES

