Assessment of the Traffic Light Model for Pediatric Sedation: Oral Surgery Cases

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Introduction

In order to maximize ideal sedation outcomes, a "Traffic Light" model was developed. This model (Fig. A) lists different complications possible for sedation procedures, as well as appropriate airway interventions to resolve them. For each level of sedation, expected airway events are deemed "Green Light", imperfect but acceptable airway events are deemed "Yellow Light", and unsafe events that require case cancellation are "Red Light". This research seeks to review Oral Surgery sedation cases completed on patients appropriate for Pediatric Dental practice (≤17yo). These Oral Surgery procedures differ from Pediatric Restorative procedures as they may entail more force, often involve soft tissue surgery, and have patients sitting in a semi recumbent position that may affect airway management. Here, we will compare the outcomes to this Traffic Light model in order to assess its accuracy, and further develop methods to increase safety/benefit of sedation procedures.

Materials and Methods

After IRB approval, we retrospectively reviewed 271 Deep IV Oral Surgery sedation charts, for cases completed between January-September 2021. All cases reviewed were patients ≤17 years of age at the University at Buffalo Pediatric Dental Residency program under the supervision of a Pediatric Anesthesiologist. All patients were appropriate NPO, ASA I or II, and had no diagnosed sleep apnea or recent respiratory disease / distress.

We evaluated two groups; Pediatric (< 13 yrs age) and Teenagers (13-17 yrs age). Midazolam, Fentanyl, and Propofol were the primary sedative agents utilized for deep Pediatric OS sedation. Airway scores and interventions were recorded and compared to the Airway Traffic Light model, and analysis for factors that correlate with Red Light events was performed.

Figure A: The Traffic light model. Different depths of sedation involve different allowances in terms of expected airway events- deeper levels sedation have greater allowances for airway events deemed acceptable
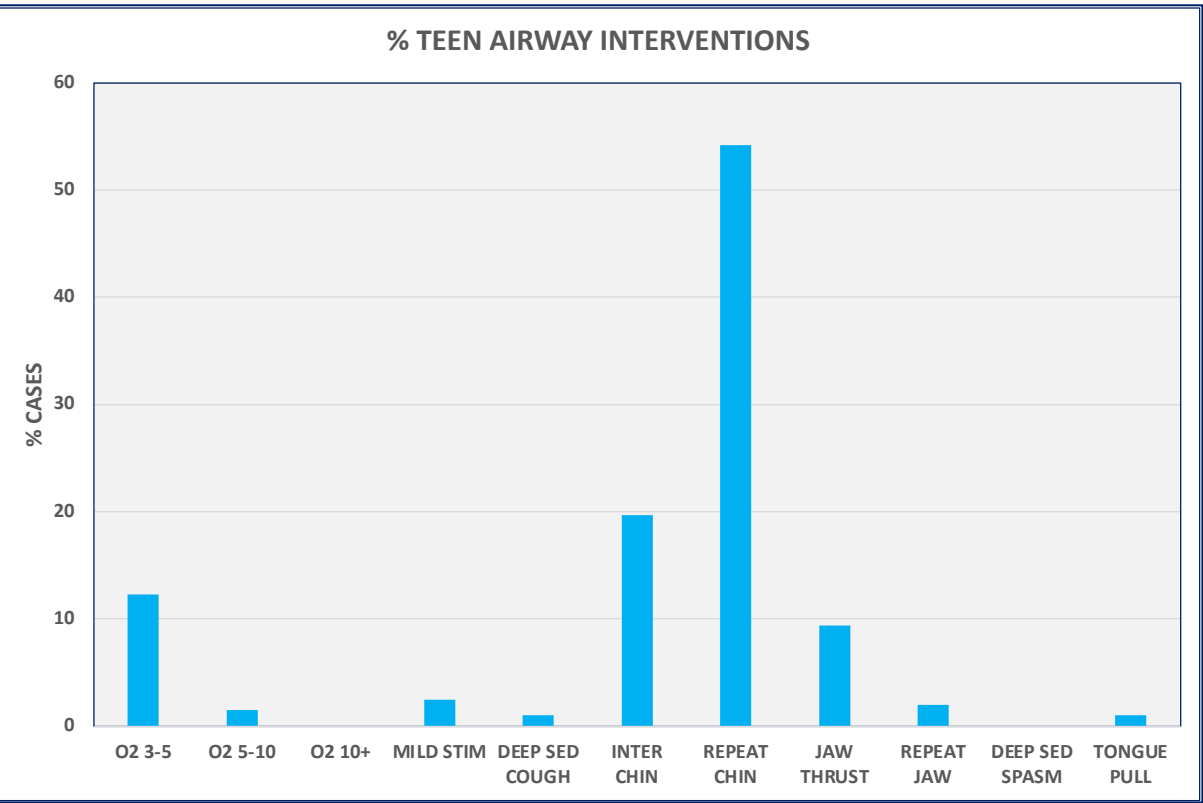
Figure B: Teenage Airway Interventions- The majority of cases required repeated chin lift, with intermittent chin lifting being the second most common intervention
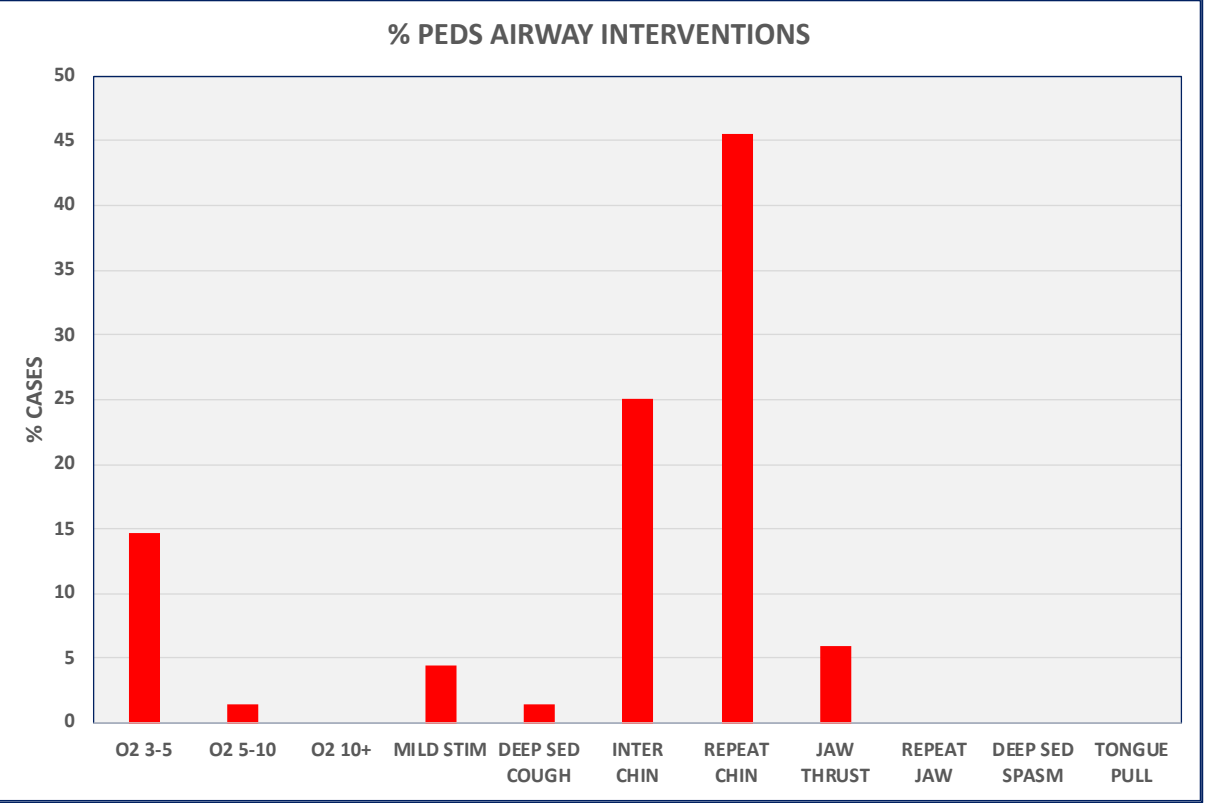
Figure C: Pediatric Airway Interventions- The majority of cases required repeated chin lift, with intermittent chin lifting being the second most common intervention. The trends in Pediatric and Teenage airway interventions had no significant differences
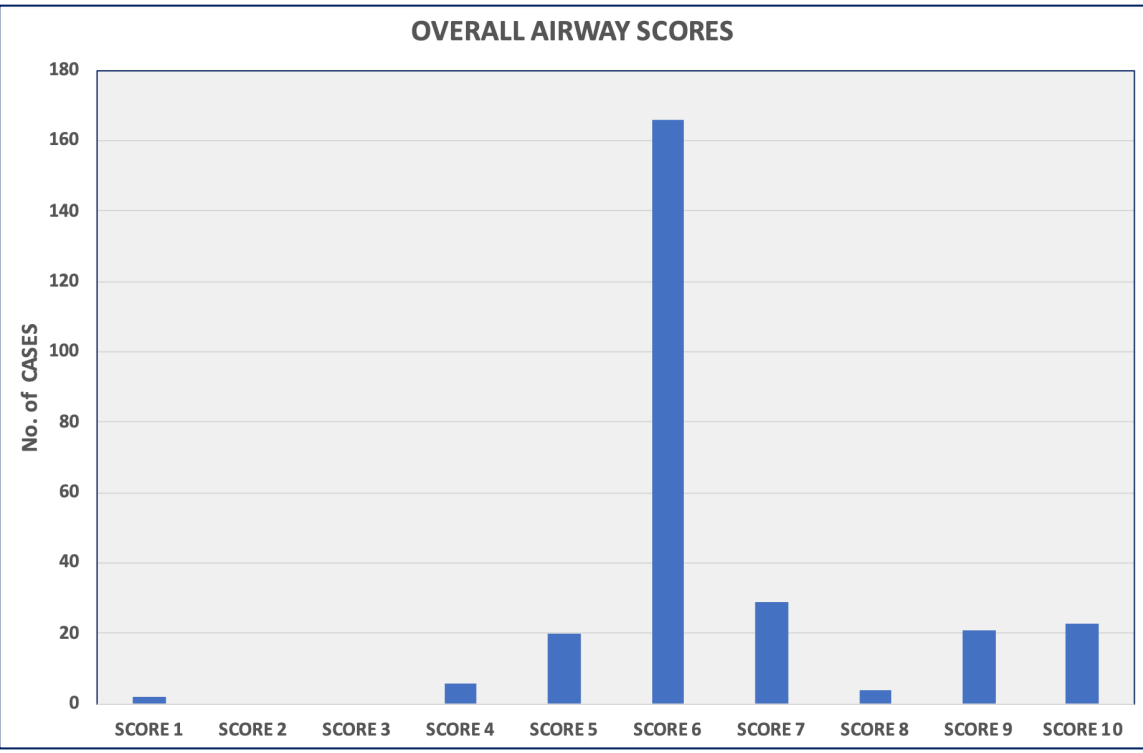
Figure D: Overall Airway Scores- The Median airway score was 6, which is classified as "Yellow Light" on the Traffic Light model. The Majority of cases scored ≥6 implying that a score of 6 may be expected (a score of ≥7 is considered "Green Light")
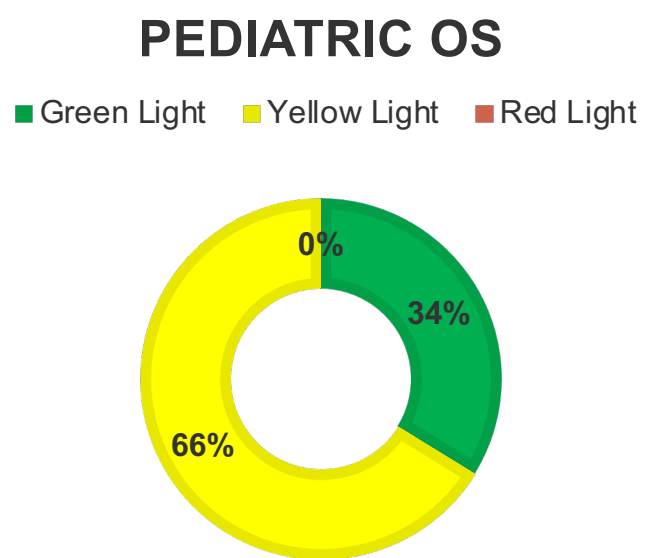
Figure E: Pediatric OS Traffic light scores: 66.2% of patients experienced "Yellow Light" events, while 33.8% experienced "Green Light" events. None experienced "Red Light" events
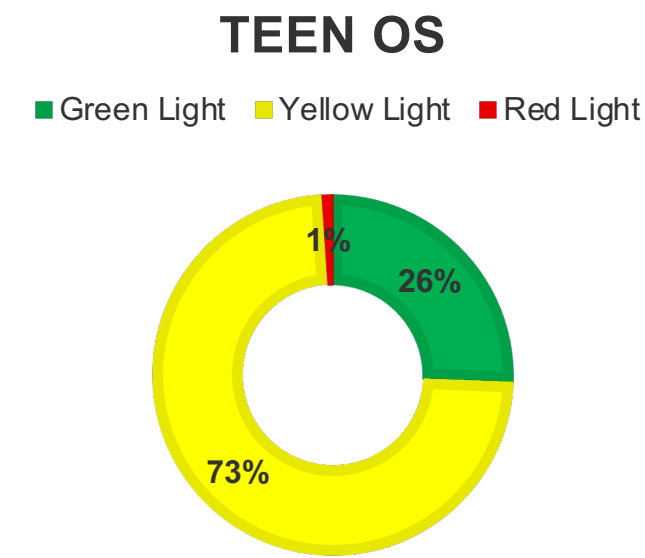
Figure F: Teen OS Traffic light scores: 73.4% of patients experienced "Yellow Light" events, 25.6% experienced "Green Light" events, and 1% experienced a "Red Light" event

Results

This group consisted of 104 males, 167 females. In the Pediatric group, mean age (years) was 9.8* ±1.7, mean weight (kg) was 42.2* ±14.8, and mean BMI was 19.1* ±3.9. The average Mallampati score was 2, and the average tonsil (Brodski) score was 1. In the Teenage group, mean age (years) was 15.8 ±1.4. The mean weight (kg) was 69.1 ±18.4. the mean BMI was 24 ±5.4. The average Mallampati score was 1, and the average tonsil (Brodski) score was 1 (*$p<0.05$ between the groups).

For sedative agents utilized in the Pediatric group, mean Midazolam dose (mg/kg) was 0.09* ±0.03, mean Fentanyl dose (mcg/kg) was 1.46 ±0.28, and mean Propofol dose (mg/kg) was 3.11* ±1.86. In the Teenage group, mean Midazolam dose (mg/kg) was 0.07 ±0.02, mean Fentanyl dose (mcg/kg) was 1.40 ±0.39, and mean Propofol dose (mg/kg) was 2.34 ±0.87 ($p<0.05$ between the groups).

Figures B/C show the incidence of the different airway interventions for Teenagers and Children. Figure D shows the overall airway scores. Figures E, F show Pediatric and Teen OS traffic light scores, respectively. There was no significant difference between the Pediatric and Teenage groups. No cases required reversal agents, succinylcholine, or airway instrumentation. Two cases required cancellation due to airway issues- These cases did not require intubation or BMV support, however due to repeated obstruction episodes resulting in desaturation, the decision was made to to re-schedule with intubation in the hospital setting. Overall, the majority of the cases required some airway intervention, but proceeded without cancellation.

Discussion

There was no difference in the airway interventions between the two groups. Pediatric airways are anatomically smaller than teenagers predisposing them to requiring more airway interventions. That effect is not seen here, however, possibly due to different nature of the Oral Surgery cases. The majority of teenage sedations involved wisdom tooth extraction, had a longer duration, and were more stimulating. Pediatric cases tended to be shorter and involved fewer extractions, or soft tissue surgery.

The most common airway intervention was a "Repeated Chin Lift", which is considered a "Yellow Light" airway event. This finding, combined with the general positive outcomes of the sedations, implies that the Traffic Light model should be revised to include "Repeated Chin Lift" as a "Green Light" (expected) airway event for deep sedation.

Other findings were consistent with the range of acceptability, as dictated by the Traffic Light model for sedation. These outcomes further supporting its credibility for use in evaluating desirable / undesirable sedation outcomes.