Assessment of the Traffic Light Model for Pediatric Dental Sedation

Rusnak, Kathleen; Goldberg-O'Neil, Ezra; Langen, Allana; Heard, Christopher

School of Dental Medicine, University at Buffalo, Buffalo, NY, USA

Introduction

Sedation dentistry is important due to the prevalence of dental caries and dental fear/anxiety among children and adolescents. Oral sedation is one of the most common forms of sedation provided by pediatric dentists; however, enteral sedation is also one of the least predictable forms of sedation. Other common forms of outpatient dental sedation include intranasal and intravenous. The American Society of Anesthesiologists along with the American Academy of Pediatrics and the American Academy of Pediatric Dentistry define levels of sedation and specific monitoring, documentation, and personnel required for each level. Despite definitions put forth from academic societies, it is quite possible for a patient to drift from one level of sedation to a deeper level, requiring the sedationist to be prepared to manage and treat a deeper level of sedation.

The traffic light model (Figure 1) was developed by pediatric anesthesiologist Dr. Christopher Heard. This model lists potential airway complications and potential airway interventions for depth and level of sedation. Airway interventions were categorized into Airway Scores so that they could be reviewed with reference to the desired depth of sedation provided. The Airway Scores are structed in a manner that reflects increasing levels of airway support, which would be expected to be associated with deeper levels of sedation as airway reflexes are more diminished.

Hypothesis: The Airway Scores increase with deeper levels of sedation, and the selected "traffic light" sequence for each level of sedation is appropriate.

Material and Methods

After approval by the University at Buffalo Internal Review Board (IRB), a retrospective chart review was performed for pediatric dental patients who received sedation from January to September 2021 at University Pediatric Dentistry in our sedation suite. Sedations were categorized by route and depth. Four types of sedation were evaluated: moderate oral (conscious) sedation, moderate intranasal sedation, moderate intravenous sedation, and deep intravenous sedation. Our traffic light airway model was applied to determine if our patient results mimic predefined expected airway outcomes. This traffic light model closely mimics appropriate airway outcomes for levels of sedation as defined by the American Society of Anesthesiology. The three airway outcomes for depth and level of sedation included: expected (green light), acceptable (yellow light), and unacceptable (red light). Data collection included patient demographics, sedation used, depth, sedation outcome and the airway intervention required.

Figure 1: Traffic Light model.

DENTAL SEDATION AIRWAY SCORE TRAFFIC LIGHT			EXPECTED AIRWAY OUTCOME		ACCEPTABLE AIRWAY OUTCOME		UNACCEPTABLE AIRWAY OUTCOME		
SCORE	AIRWAY INTERVENTION:	EXAMPLE: PED MIN INH SEDATION	EXAMPLE: PED MOD ORAL SEDATION	EXAMPLE: PED MOD IN SEDATION	EXAMPLE: PED MOD IV SEDATION (POSS RESCUE)	EXAMPLE: ADULT MOD IV SEDATION	EXAMPLE: PED DEEP IV SEDATION	EXAMPLE: ADULT DEEP IV SEDATION	EXAMPLE: PED DEEP INH SEDATION	SCORE
1A	CASE CANCELLED / STOPPED DUE TO AIRWAY OR ETT OR LMA USE REQUIRED									1A
2A	BMV REQUIRED, OR REVERSAL AGENTS. OR SUX FOR SPASM									2A
3A	ORAL OR NASAL AIRWAY									3A
4A	TONGUE PULL OR REPEATED JAW THRUSTS.									4A
5A	JAW THRUST REQUIRED OR FURTHER ADDITIONAL OXYGEN (10L+), 100% O2, OR DEEPER SEDATION SPASM									5A
6A	OXYGEN SUPPLEMENTATION INCREASED (5L+) , ≥50 %O2, OR CONTINUED CHIN LIFT									6A
7A	INTERMITTANT CHIN LIFT OR DEEPER SEDATION FOR COUGH									7A
8A	OXYGEN SUPPLEMENTATION INCREASED (3L+), ≥30% O2 OR ADDITION OF O2									8A
9A	SNORING, COUGHING, MILD STIMULATION REQUIRED									9A
10A	NO AIRWAY ISSUES, EITHER NO O2 (PO) OR NC/ETCO2 O2 2L/MIN									10A
SCORE	AIRWAY INTERVENTION:	EXAMPLE: PED MIN INH SEDATION	EXAMPLE: PED MOD ORAL SEDATION	EXAMPLE: PED MOD IN SEDATION	EXAMPLE: PED MOD IV SEDATION (POSS RESCUE)	EXAMPLE: ADULT MOD IV SEDATION	EXAMPLE: PED DEEP IV SEDATION	EXAMPLE: ADULT DEEP IV SEDATION	EXAMPLE: PED DEEP INH SEDATION	SCORE

Results

A total of 595 sedation charts were analyzed. Patient demographics are shown in Table 1. The distribution of Airway Scores in all cases is shown in Figure 2. Overall 6.22% of total patients experienced red light events, 52.27% experienced yellow light events, and 41.52% had green light events. There is a significant difference between distribution of traffic light scores and the type of sedation (Table 2). This difference in airway interventions is shown in Figures 3a-c. Moderate intravenous sedation had the greatest number of red light events (30 cases). T-test analysis of age, weight, height, BMI, ASA, Mallampati, Brodsky Tonsil score, Midazolam, Fentanyl or Dexmedetomidine use shows no statistical significance. However, Propofol adjunct use was clinically significant for red light events for moderate intravenous sedation (*p=0.001*).

Table 1. Patient Demographics and Behavior Score (Average)

	Age	Weight	BMI	MP	Tonsils	Behavior Score (Median)
MOD PO/IN	5.8*	25.3	17.2	2	1	8*
MOD IV	7.4*	33.3	18.9 #	2	2	8.5*
DEEP IV	6.5*	26.9	17.0	2	2	10*

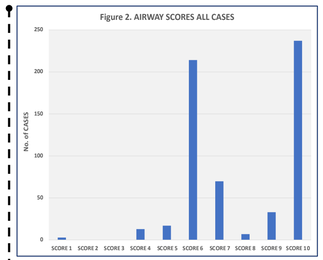
** p < 0.01 between all three groups (ANOVA with Tukey post hoc)*

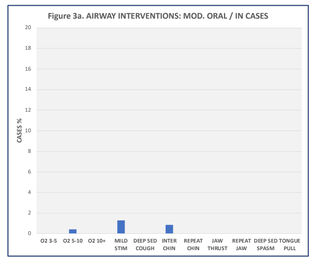
 # p < 0.01 between MOD IV and other two groups (ANOVA with Tukey post hoc)

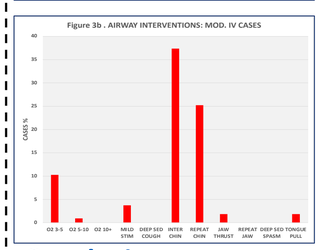
Table 2. Traffic Light Outcome (%) by Sedation Type

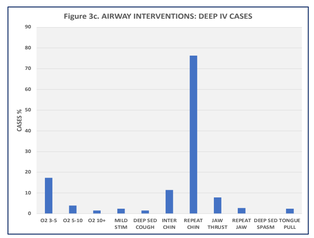
	GREEN	YELLOW	RED
MOD PO/IN	89.2	9	1.7
MOD IV	1.9	70.1	28
DEEP IV	14.2	84.6	1.2

Results Continued









Conclusions

Interestingly, the most red light events (30 cases) were seen in moderate intravenous sedation where the sedation was deeper than planned and in some cases more closely resembled deep intravenous sedation. Note: A red light event for MOD IV sedation would be considered a yellow light event for DEEP IV sedation. With respect to the "deep" moderate sedation cases, as a pediatric anesthesiologist was providing direct care and monitored each patient, it is acceptable for a patient to be more deeply sedated.

Overall the traffic light sequence appears appropriate for each sedation level and it appears to be a useful tool to help practitioners remain within their scope for sedation practice. Moderate PO/IN sedation appears to be the safest sedation for dental children, understanding that it has efficacy limitations.