Comparing Sedation Outcomes for Pediatric and Oral Surgery Patients

University at Buffalo
School of Dental Medicine

Taylor K, Heard C

State University of New York University at Buffalo, Department of Pediatric and Community Dentistry

Introduction

University Pediatric Dentistry offers different levels of sedation. The level of sedation is dependent on the amount of treatment required and expected treatment time. Deeper levels of sedation often provide better sedation conditions, however they do involve a higher risk for complications, notably airway. Also, they may require more specialized sedation providers, additional support staff and specialized equipment. These additional factors may all increase the costs of the provided sedation. The aim of this retrospective study is to compare the behavioral outcomes of sedation with respect to different types of sedation for pediatric dental and oral surgery patients and also evaluate the outcomes for Special Needs patients.

Methods

After IRB approval, the sedation records of all pediatric and oral surgery (OS) sedation patients from the UPD sedation suite, were reviewed from January - December 2021. The outcomes of sedation were graded using a behavior score and airway score (Table 1). Higher behavior score is associated with more positive behavioral outcome from the procedure. The behavior score was used to compare the sedation outcome of pediatric patients undergoing oral (PEDO PO), intranasal (PEDO IN), and IV mod. sedation (PEDO MOD IV) and IV deep sedation (PEDO DEEP IV) and IV deep sedation oral surgery (OS). The behavior score was assessed by both the sedation provider and the operator. The behavior score involves the following features:

- Level of procedural completion
- Noise throughout procedure
- Movement throughout procedure
- Sedation requirements
- Over-sedation

Data reviewed also included:

Procedure type, Patient demographics, Medical history and Medications, Sedation dosing . A separate analysis was performed for pediatric patients with special needs (ADHD, ASD, DD) and adults with multiple psychotropic medication use.

Table 1. Outcome scores

SCORE	AIRWAY INTERVENTION:	SCORE	BEHAVIOR INTERVENTION:
1A	CASE CANCELLED DUE TO AIRWAY, or ETT / LMA USE REQUIRED	1B	FAIL: PROC. NOT STARTED DUE TO BEHAVIOR OR OVERSEDATION
2A	BMV REQUIRED, or REVERSAL AGENTS, or SUX FOR SPASM, or CASE INCOMPLETE DUE TO AIRWAY	2B	FAIL: PROC. ONLY MINIMALLY COMPLETE, TOO COMBATIVE OR AGITATED: OR DUE TO OVERSEDATION
3A	ORAL or NASAL AIRWAY	3B	POOR: PROC. ONLY PARTIAL COMPLETE, OR CASE COMPLETED WITH CONSTANT RESTRAINT OR DUE TO OVERSEDATION
4A	TONGUE PULL, or REPEATED JAW THRUSTS	4B	POOR: PROC. MOST COMPLETED, MULTIPLE BOLUSES WITH SIGNIFICANT DELAY, PROLONGED RESTRAINT
5A	JAW THRUST REQUIRED, or OXYGEN INCREASED (10L+), 100% O2, or DEEPER SEDATION SPAM, or PROCEDURE INTERUPTED FOR ANY AIRWAY MANEUVER	5B	MOD: PROC. MOST / ALL COMPLETED, CONSTANT MOVEMENT, INTERMITTANT RESTRAINT OR ADJUNCT SEDATIVE USED OR OVERSEDATION ALL COMPLETED
6A	OXYGEN SUPPLEMENTATION INCREASED (5L+), 150 NO2, or REPEATED CHIN LIFT, or REMOVAL OF INTRAORAL DEVICE (BB, PROP, GAUZE, ISOLITE)	6B	MOD: PROC. MOST / ALL COMPLETED, REPEATED MOVEMENT, REPEATED EXTRA BOLUS NEEDED WITH MILD DELAY OR OVERSEDATION REQUIRE PHYSICAL STIM.
7A	INTERMITTANT CHIN LIFT, or DEEPER SEDATION FOR COUGH, or ADJUSTMENT OF INTRAORAL DEVICE (BB, PROP, GAUZE, ISOLITE)	7B	GOOD: PROC. COMPLETED, REPEATED HEAD MOVEMENT OR EXTRA BOLUS NEEDED OR OVERSEDATION REQUIRE VERBAL STIM.
8A	OXYGEN SUPPLEMENT. INCREASED (5L+), ±30% O2, or O2 ADDED, or HEAD REPOSITIONED or GLYCOPYRROLATE FOR COUGHING, or PAINFUL STIMULATION REQUIRED	8B	GOOD: PROC. COMPLETED, REPEATED PERIPHERAL MOVEMENT OR SLIGHT HEAD MOVEMENT
9A	SUCTION FOR COUGHING, or MILD STIMULATION REQUIRED	9B	EXC: PROC. COMPLETED, INTERMITTANT PERIPHERAL MOVEMENT
10A	NO AIRWAY ISSUES, EITHER NO O2 (PO) or NC/ETCO2 O2 (SUNK	10B	EXC: PROC. COMPLETED, NO NOISE OR MOVEMENT

Table 2: Demographics	Number of Cases	Average Age (years)	% Female Gender	Average Weight (kg)	Average BMI
PEDO PO	297	5.9	52.8	25.6	17.1
PEDO IN	37	5.2	48.6	21.9	16.5
PEDO MOD IV	136	7.4	41.9	32.9	18.8
PEDO DEEP IV	331	6.5	47.7	27.4	17.3
OS CHILD	47	9.6	48.9	43.0	19.9
OS TEEN	351	15.7	61.5	68.4	23.9
OS ADULT	36	20.7	66.7	66.8	24.2

Table 3: Medical Histoy	Asthma	ASD	ADHD	Behavior Issues	Taking Psych. Meds
PEDO PO	12.4	5.4	6.0	1.3	1.0
PEDO IN	0.0	18.9	0.0	5.4	0.0
PEDO MOD IV	9.6	5.9	5.9	0.7	1.5
PEDO DEEP IV	10.6	1.8	5.1	0.9	2.4
OS CHILD	17.0	2.1	8.5	0.0	0.0
OS TEEN	13.7	1.1	5.1	0.0	6.8
OS ADULT	5.6	5.6	0.0	0.0	5.6

Table 4: Sedation dosing	Midazolam No. of Doses	Midazolam Dose mg/kg	Fentanyl No. of Doses	Fentanyl Dose mcg/kg	Propofol Dose mg/kg
PEDO PO	1.0	0.64			
PEDO IN	1.0	0.46			
PEDO MOD IV	4.5	0.15	2.7	2.0	1.8
PEDO DEEP IV	3.5	0.13	2.7	1.8	5.3
OS CHILD	2.6	0.09	2.7	1.7	2.7
OS TEEN	2.5	0.07	2.7	1.4	2.3
OS ADULT	2.8	0.08	2.9	1.5	2.4

Table 5: Behavior Score (%)	PEDO PO	PEDO IN	PEDO MOD IV	PEDO DEEP IV	OS CHILD	OS TEEN	OS ADULT
BEH SCORE 1	0.0	0.0	0.0	0.0	0.0	0.6	0.0
BEH SCORE 2	0.3	0.0	0.0	0.0	0.0	0.0	0.0
BEH SCORE 3	2.7	2.7	0.0	0.0	0.0	0.3	0.0
BEH SCORE 4	0.3	0.0	2.9	0.0	0.0	0.3	0.0
BEH SCORE 5	10.7	16.2	18.4	0.3	0.0	0.0	0.0
BEH SCORE 6	9.4	2.7	16.9	1.2	0.0	0.9	0.0
BEH SCORE 7	15.7	37.8	16.9	5.4	4.3	5.1	5.6
BEH SCORE 8	25.4	21.6	8.1	5.4	4.3	9.4	11.1
BEH SCORE 9	20.1	8.1	20.6	23.9	19.1	24.7	38.9
BEH SCORE 10	15.4	10.8	16.2	62.8	72.3	56.0	44.4

Shaded area 25th-75th percentile

Table 6: Airway Score (%)	PEDO PO	PEDO IN	PEDO MOD IV	PEDO DEEP IV	OS CHILD	OS TEEN	OS ADULT
AIR SCORE 1	0.0	0.0	0.0	1.2	0.0	0.6	0.0
AIR SCORE 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIR SCORE 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIR SCORE 4	0.0	0.0	1.5	4.2	6.4	4.5	5.6
AIR SCORE 5	0.0	0.0	2.2	7.6	8.5	6.5	11.1
AIR SCORE 6	0.3	0.0	22.1	71.3	63.8	60.8	58.3
AIR SCORE 7	1.7	2.7	41.2	10.9	6.4	11.4	8.3
AIR SCORE 8	0.0	0.0	4.4	0.9	2.1	1.7	0.0
AIR SCORE 9	9.4	18.9	8.1	2.4	4.3	5.7	0.0
AIR SCORE 10	88.6	78.4	20.6	1.5	8.5	6.8	16.7

Shaded area 25th-75th percentile

Table 7: Special Needs Patients	% Cases Special Needs	AGE (average years)		BMI (average)		MID Dose (average mg/kg)		Fent Dose (average mcg/kg)		Prop Dose (average mg/kg)		Behavior Score (average)		Airway Score (average)	
		NON SN	SN	NON SN	SN	NON SN	SN	NON SN	SN	NON SN	SN	NON SN	SN	NON SN	SN
PEDO PO	13.4	5.7	7.4	17.1	17.3	0.65	0.60	-	-	-	-	7.7	7.8	9.8	9.9
PEDO IN	24.3	4.6	6.9	16.7	15.9	0.47	0.42	-	-	-	-	6.9	8.4	9.7	9.8
PEDO MOD IV	11.8	7.3	8.8	18.7	19.9	0.15	0.14	1.99	1.90	1.81	1.69	7.3	7.6	7.5	7.5
PEDO DEEP IV	8.5	6.4	8.4	17.0	19.5	0.13	0.12	1.8	1.7	5.4	4.8	9.4	9.3	6.0	6.1
OS CHILD	8.5	9.7	8.5	19.8	20.4	0.09	0.10	1.7	1.6	2.8	2.0	9.5	10.0	6.3	6.3
OS TEEN	11.8	15.9	16.3	24.1	22.7	0.07	0.07	1.4	1.5	2.3	2.1	9.3	9.4	6.4	6.6
OS ADULT*	13.9	20.7	20.4	24.6	21.8	0.07	0.12	1.5	1.7	2.2	4.0	9.4	8.2	6.6	6.2

Shaded area Significant difference ***p< 0.05*** *between SN and Non-SN patients*

Results

** Adult patients with multiple psychotropic medication use rather than special needs*

From this period, we reviewed 1233 sedation records. There were 803 Pediatric Dental (2 to 18 years, and 93 with special needs) and 430 Oral Surgery cases (6 to 25 years). The most common types of sedation were Deep IV and OS Teens. Most moderate sedations involved PO medication administration (Table 2). The midazolam dosing (mg/kg) was higher for the moderate sedation groups (PO, IN, and IV) than it was for the deep sedation groups (DEEP IV and OS) (Table 3). ASD, ADHD and DD were not uncommon in the pediatric patients, and ASD was more common in the PEDO IN group (Table 4). Behavior scores were highest (better outcome) for the deep IV sedation groups (DEEP IV and OS:) and lowest (Worse outcome) in PO and IN sedations (Table 5). Airway scores were highest in PO and IN sedations and lower in Deep IV sedations (Table 6). Special needs outcomes are shown in table 7. The quality of sedation for the special needs was no worse except for OS adults (multiple psychotropic meds use) whose sedation was a little less effective, despite significantly higher sedation dosing. Airways scores for all sedation groups were similar between SN and non SN patients.

Discussion

Our primary outcome was Differences between moderate and deep sedation with regards to Behavior and Airway. Deeper sedation, resulted in a better outcome. For moderate level of sedation, there was not much benefit from PEDO MOD IV compared to PEDO PO and PEDO IN. The PEDO MOD IV results are slightly skewed because the patients with poorer behavior were converted to deep IV sedation. Older patients in PEDO MOD IV, expected to sedate better than younger PEDO PO patients, often sedated worse. This may be related to a different expectation of dentist. Moderate sedation efficacy is limited, irrespective of drug or route of administration. The midazolam dosing (mg/kg) is higher for the moderate sedation procedures because it is providing all/more of the sedation effects than in the deep sedation categories. The IN dosing method was often chosen for patients with ASD in order to achieve successful administration of the medication. In each of the sedation groups, there were a significant number of children with special needs. In general, patients with special needs were older than their counterparts. For the child sedations, there was no difference in the quality of sedation and no increased sedation requirement. For the OS ADULT patients, there was a small but significant difference in the quality of the sedation despite significantly increased dosing. The airway scores reflected the effects of deep sedation. For the moderate PO/IN sedation patients, the airway scores were consistently high (mostly 9-10). For the deep sedation cases, the airways scores reflected the expected need for airway support (4-6). The PEDO MOD IV ranged from 4-10 due to the use of deep sedation for some patients.

Conclusion

Increased depth of sedation improved behavior outcomes, however this results in increased risks for airway complications. Sedation for SN patients was equally effective for all sedation types.