Developing a Pediatric Dental Procedure Score

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Introduction

Children often require sedation for dental care; however, creating a referral to the appropriate sedation type can be confusing. University Pediatric Dentistry (UPD) offers several levels of sedation: nitrous oxide, oral/intranasal moderate sedation, intravenous moderate sedation, intravenous deep sedation, inhalation deep sedation and general anesthesia (Table 1). The need for sedation is based on behavior level, age, medical history and amount of planned treatment. The appropriate sedation type for each patient depends on the dental procedure complexity, number of quadrants and expected amount of local anesthesia. Recognizing the need for a systematic approach, this study introduces a Dental Procedure Score (Table 2). This score is developed by assessing planned procedure complexity and adjusting it based on patient-specific modifiers (Table 3). The primary objective is to create a comprehensive decision algorithm that incorporates the Dental Procedure Score, facilitating a more informed and streamlined process for dental sedation referrals. This algorithm aims to enhance the precision of selecting the appropriate sedation type based on individual patient needs, contributing to improved dental care outcomes for pediatric patients.

Table 1. Types of Sedation and Chart Review Source

1. NITROUS OXIDE (N2O)	DENTAL EMR
2. ORAL / IN MODERATE (PO/IN)	SEDATION RECORD
3. MODERATE IV (MOD IV)	SEDATION RECORD
4. DEEP IV	SEDATION RECORD
5. DEEP INHALATIONAL (SEVO)	SEDATION RECORD
6. OPERATING ROOM GA (OR)	DENTAL EMR

Table 2. Dental Procedure Score

PROCEDURE	Score	PROCEDURE	Score
SSC	6	PED POST XO	4
SC	7	PED ANT XO	3
PED RESIN 1S	3	ADULT POST XO	7
PED RESIN 2S	6	ADULT ANT XO	5
PED RESIN 3S	7	PULP	5
PED RESIN 4S	8	SEALANT	2
ADULT RESIN 1S	5	OTHER	3
ADULT RESIN 2S	7	ROOT TIP XO EASY	3
ADULT RESIN 3S	8	ROOT TIP XO HARD	7
ADULT RESIN 4S	9	ADULT SC	8
		ADULT SSC	7

Table 3. Modifiers and Other Factors

- Number of operative Quadrants
- % Maximum Local Anesthesia carpules required / used, based upon AAPD guidelines (4.4 mg/kg, [34 mg carpule] LIDOCAINE, and/or 7 mg/kg ARTICAINE [68 mg carpule])
- Age ranges: 2 to 21 years (AGE BY GROUPS SEDATION RELATED)
- Medical Conditions:
  - IDDM
  - Obesity: (BMI > 40 (> 15 years) or BMI > 35 (< 15 years)
  - OSA
  - Seizure within 6 months
  - Other concerns: Cardiac / Respiratory / Renal / Hepatic / Neuro
- Behavior Concerns: ADHD, Autism, DD, psychotropic or anti-epileptic medication use

Methods

The initial phase of this retrospective study involved the random review of sedation and dental electronic medical records of pediatric patients aged 2-17 years old, spanning from January 2021 to December 2022. The records were de-identified to ensure patient privacy. A random selection of 50 charts for each sedation type (N2O, PO/IN, MOD IV, DEEP IV, SEVO and OR) was included in the initial review. The pediatric dental procedures scored comprised stainless steel crowns, strip crowns, resin restorations, extractions, pulpotomies and sealants. Each procedure was assigned a score based on consensus among faculty members. The cumulative score for all procedures undertaken by a patient constituted the Dental Procedure Score. Respective patient demographics, medical histories, procedural details and modifiers were also collected and entered into an Excel spreadsheet for further analysis. Comparative data analysis and descriptive statistics were conducted to examine various aspects of the study population. Group comparisons were made based on demographics, specific dental procedures, Dental Procedure Score and patient modifiers. Statistical methods were applied to identify significant factors influencing the choice of sedation type. All methods aimed to contribute to the development of a decision algorithm for streamlined and effective dental sedation referrals.

Results

After IRB approval, 300 records were retrospectively reviewed. The average age of pediatric patients ranged from 4.6 to 8.6 years old (Figure 1). PO/IN, MOD IV and DEEP IV ages were the same. There was a notable difference in BMI between the PO/IN and MOD IV groups (Table 4). No significant differences were observed in the prevalence of special needs across the various sedation groups. Airway scores differed significantly between groups PO/IN, MOD IV, DEEP IV and SEVO. Behavioral scores demonstrated significant differences between groups N2O, PO/IN and MOD IV, compared to groups DEEP IV and SEVO. As expected, behavioral improvement was observed with deeper sedation modalities (Figure 2). The number of quadrants treated was similar for N2O, PO/IN and SEVO, as well as for DEEP IV and OR (Table 5). LA use varied with sedation type and there was notably an overall significant difference in planned versus actual treatment across all groups. Procedure times are shown in Figure 3. The SEVO cases were significantly shorter. Table 6 displays a comprehensive account of procedure details for each sedation type. The individual component scores are shown in Table 7. The overall Dental Procedure Score for each sedation type is the following: N2O (5.6), PO/IN (7.8), MOD IV (16.2), DEEP IV (32.5), SEVO (10.4) and OR (36.3). Overall the average Dental Score was 18.1 (SD 13.7: range 1.5 to 60). Significant differences were identified among all groups except DEEP IV and OR, as well as N2O and PO/IN (Figure 4).

Table 4. Patient Demographics by Group

	NUMBER	AGE (average)	WEIGHT (average)	BMI (average)	% OSA	% OBESITY	% IDDM	% SPECIAL NEEDS
NITROUS	50	8.7	31.7	17.9	2	4	4	8
PO/IN	50	5.9	25.5	16.4	0	12	0	6
MOD IV	50	7.5	31.6	18.6	0	26	0	12
DEEP IV	50	6.5	27.0	17.0	0	12	0	6
SEVO	50	7.2	28.2	17.0	0	6	0	14
OR	50	4.6	21.3	17.0	4	10	2	6

Table 5. Overall Procedure Details by Group

	NO.QUAD (average)	LIDO CARP. (average)	ARTI CARP. (average)	% NO LA Used	PLANNED Procedure	ACTUAL Procedures
NITROUS	1.2	0.2	0.6	18.4	2.0	2.1
PO/IN	1.6	0.0	1.1	4.0	2.8	3.3
MOD IV	2.8	0.2	1.3	4.0	5.0	5.7
DEEP IV	3.9	0.0	1.1	2.0	8.9	10.2
SEVO	1.7	0.0	0.6	10.0	2.8	3.6
OR	3.9	0.0	0.0	100.0	10.1	11.4

Table 6. Dental Procedures Performed by Group

% CASES	SSC	SC	PED RESIN	ADULT RESIN	PED XO	ADULT XO	PULP	SEALANT
NITROUS	28	0	34	32	14	4	10	10
PO/IN	48	0	28	16	58	4	16	20
MOD IV	68	0	12	34	56	12	18	40
DEEP IV	86	2	24	22	70	12	50	28
SEVO	54	0	16	8	72	4	24	16
OR	98	18	34	4	62	0	54	20

Table 7. Average Scores by Procedure by Group

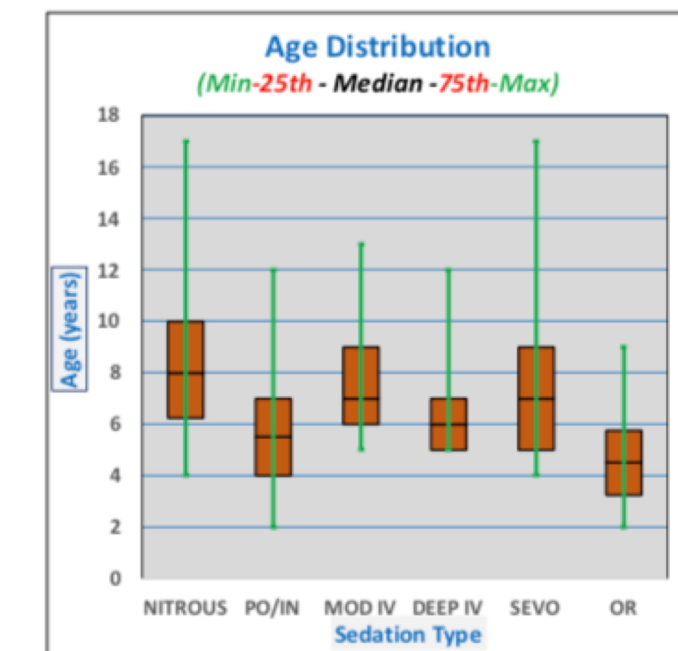| AVE/CASE	SSC	SC	PEDS RESIN	ADULT RESIN	PEDS XO	ADULT XO	PULP	SEALANT	D-SCORE
NITROUS	1.5	0.0	1.4	1.4	0.4	0.2	0.2	0.2	5.5
PO/IN	2.9	0.0	0.8	0.4	2.5	0.2	0.3	0.8	7.8
MOD IV	8.6	0.0	0.3	1.7	3.2	0.6	0.5	1.2	16.2
DEEP IV	19.6	0.1	1.0	1.3	6.4	1.5	1.7	0.8	32.5
SEVO	4.2	0.0	0.6	0.4	3.8	0.3	0.5	0.5	10.4
OR	23.7	3.0	1.9	0.2	5.2	0.0	1.8	0.7	36.3

Figure 1. Age Distribution by Group

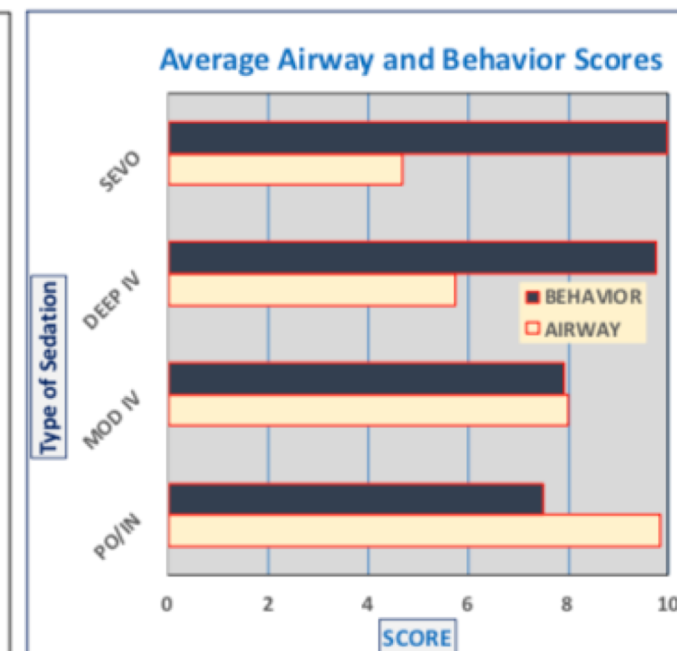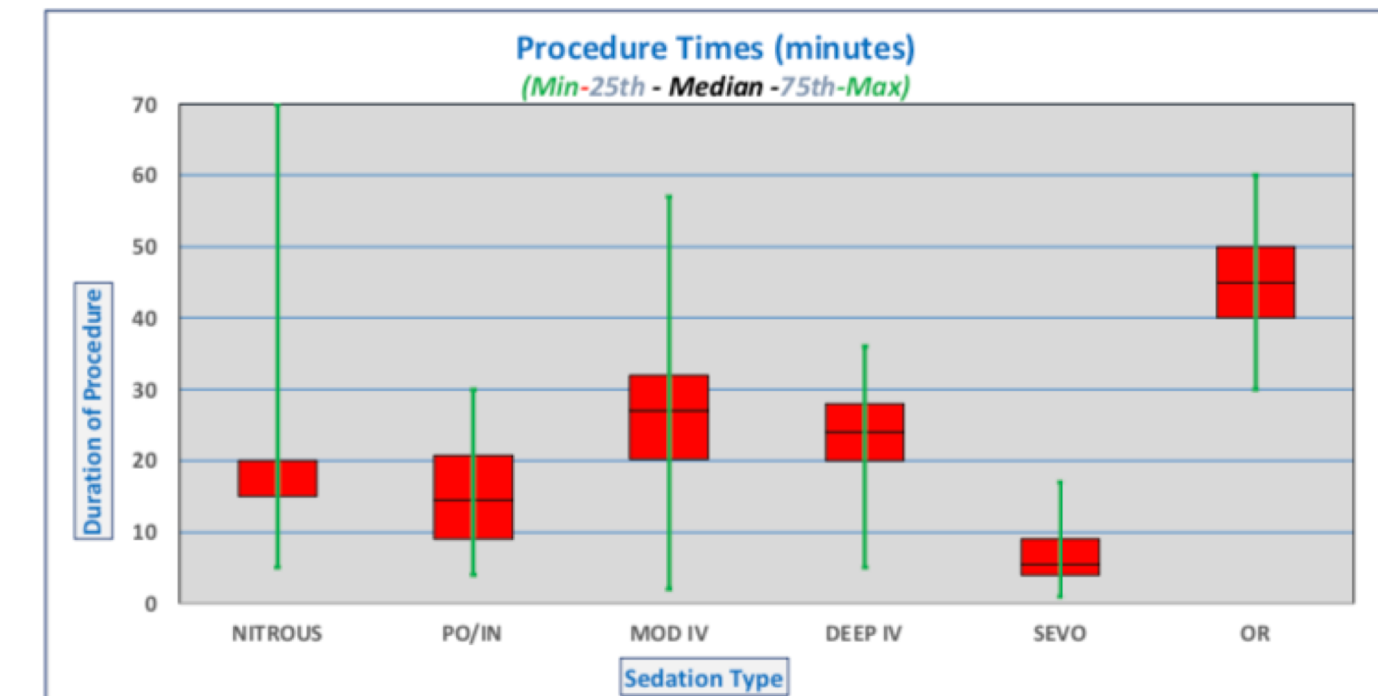Figure 2. Airway & Behavior Scores by Group

Figure 3. Distribution of Procedure Times by Group

Figure 4. Distribution of Dental Score by Group

Discussion

The sedation types did have significant differences as expected with respect to procedures, timing, airway intervention and behavior scores. The deeper the sedation, the better behavior and the more airway intervention required. The Dental Procedure Score appeared to delineate between the different sedation types. DEEP IV and OR were very similar, and N2O, PO/IN and SEVO were similar. Unfortunately, there were few patients with medical conditions, such as OSA and IDDM, that related to specific sedation type selection. This will need further evaluation in the future. As originally planned, the Dental Procedure Score will further be refined by including this score along with a few new factors. The pre-sedation initial office behavior (Frankl Score) and previous sedation types utilized for dental care are important items to consider. Also, as access to the local Children's Hospital becomes more difficult, UPD has increased the available sedation options to accommodate the potential increased office based sedation demand. This includes using Laryngeal Mask Airways for moderate to large cases. As such, this will need to be included in the subsequent analysis. A review of patients from 2023 is planned as the next phase of this study. This subsequent analysis will provide insights into how well the algorithm performs at UPD, offering an opportunity for further adjustments and improvements. The study's preliminary findings indicate the appropriateness of the Dental Procedure Score and with further evaluation it will help in streamlining sedation referral selection.