TROOPS Research Tool for Dental Sedation Continuous Quality Improvement

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Introduction

The American Academy of Pediatric Dentistry has been publishing guidelines for pediatric sedation by dentists since at least 1986[1]. In the early 2000s, the American Academy of Pediatrics and American Academy of Pediatric Dentistry formed a "work group on sedation". The result was a set of guidelines for pediatric sedation that was agreed upon by both organizations and published in the journal Pediatrics in 2006[2]. These guidelines recommended the implementation of a "continuous quality improvement" system in facilities providing sedation to reduce risk and improve patient outcomes. The guidelines recommended the recording of adverse events including the following: desaturation; apnea; laryngospasm; the need for airway interventions (including the need for a jaw thrust maneuver, positive pressure ventilation, or placement of an airway); prolonged sedation; unanticipated use of reversal agents; unintended or prolonged hospital admission and unsatisfactory sedation, analgesia or anxiolysis; and the inability to complete the procedure[2,3].

The recommendation for a continuous quality improvement scheme has remained with minimal changes since its adoption and into the most current AAPD best practices for sedation[3]. However, limited information is available to assist practitioners in exactly how to implement such a system.

In 2018, the International Committee for the Advancement of Procedural Sedation proposed a standardized survey tool to be used for continuous quality improvement and a second tool for sedation quality research[4]. The tools were designed to be used by all types of sedation providers and in any location worldwide via the collection of consistent and standardized data[4]. Consistent with the 2009 Quebec Guidelines for Paediatric Sedation Research, the tools focus on recording the use of unintended interventions and adverse events instead of simply recording the previously listed events with the proposition that more consistent and less ambiguous information would be recorded[4].

The research tool has a select list of interventions for problems in the following categories: airway and breathing, cardiovascular, gastrointestinal, neurological, allergy, and sedation quality and patient experience. These interventions are further separated into "Minor", "Intermediate", and "Sentinel" divisions. The quality improvement tool omits the minor interventions. Both tools provide a section for "suspected etiologies" for the recorded interventions and outcomes as well as an area for freeform text to record findings that are not listed. The group also maintains a data collection website to record and analyze the recorded data (http://ProceduralSedation.org)[4].

Purpose

The purpose of this project was to evaluate the usefulness of the TROOPS Comprehensive Research Tool in pediatric dental sedations in a clinic setting and to report unplanned interventions and events that presented during the study sedation sessions.

Materials and Methods

Three hundred oral sedations were performed on dental patients ranging in ages from 2 to 12 years old. A medical history and assessment performed and a signed consent for sedation was acquired for each patient. Only patients with an ASA classification of I or II were included. Those with severe or uncontrolled systemic disease were not considered as candidates for in-office sedation. Medical consultations and clearances were obtained as necessary.

Candidate patients were prescribed either a combination of meperidine (2 mg/kg; with a maximum dose of 100 mg) and hydroxyzine (1.5 mg/kg; with a maximum dose of 50 mg) or a combination of diazepam (0.5 mg/kg; with a maximum dose of 10 mg) and hydroxyzine (1.5 mg/kg; with a maximum dose of 50 mg). All patients were verified to be NPO for at least 8 hours prior to the administration of medications, Patients were kept in a waiting room for one hour between the administration of medications and being taken to the dental operatories.

All subjects were placed in a semisupine position in a dental chair. A mixture of nitrous oxide and oxygen was administered to patients via a multi-use nasal hood and was titrated to maintain an expanded reservoir bag. Nitrous oxide was administered at an initial percentage of 40-50% and increased incrementally as needed due to patient response.

Multiple blood pressure readings were recorded, and the pulse and heart rate were continuously monitored with a pulse oximeter. Chest rise and skin color were continuously monitored and auscultation with a stethoscope was performed as needed.

Average patient behavior during treatment was recorded using a four-point numeric scale corresponding to the Frankl behavior scale (Table 1). Average depth of sedation was recorded using a four-point scale as seen in Table 2.

When possible, restorations and/or extractions were completed with the addition of local anesthesia. Treatment was generally limited to a single quadrant or sextant. When possible, the teeth were isolated with either an IsoDry Dental Isolation System (Zyris) or an unfolded 2x2 inch gauze. Passive immobilization with a papoose-type restraint board or wrap was not employed. On rare occasions and when indicated, active immobilization was employed with the child's parent or guardian restraining the arms and legs and the doctor stabilizing the head and mouth.

Following each of the 300 sedations, data was recorded on the TROOPS Comprehensive Research Tool (International Committee for the Advancement of Procedural Sedation) including unplanned outcomes or interventions in the "Minor", "Intermediate" and "Sentinel" categories. In addition, unlisted interventions and conditions were also noted. The data was entered into Microsoft Excel for analysis.

Table 1: Frankl Behavior Scale[5,6]

Behavior Rating	Rating Description	Associated Behavior
1	DEFINITELY NEGATIVE	Refusal of treatment, crying forcefully, fearful, and/or extreme negativism
2	NEGATIVE	Reluctant to accept treatment, uncooperative, sullen, withdrawn, and/or some evidence of negative attitude
3	POSITIVE	Willingness to comply with dentist and cooperation with treatment, possibly with caution or reservation
4	DEFINITELY POSITIVE	Cooperative, good rapport with the dentist, interested in the dental procedure, and possibly laughing and enjoying the procedure

Table 2: Sedation Rating Scale[3,7,8,9]

Sedation Rating	Sedation Level	Associated Observations
1	Minimal (Previously Anxiolysis)	Airway independently and continuously maintained by the patient, patient responsive to light physical stimulation or verbal command, possible modest impairment of cognitive function and coordination without impairment of ventilatory or cardiovascular functions
2	Moderate	Depressed consciousness with purposeful response to verbal commands with or without light tactile stimulations, independent maintenance of airway patency and spontaneous ventilation without intervention, and independent maintenance of cardiovascular function
3	Deep	Depression of consciousness resulting in difficulty rousing the patient with response to repeated or painful stimulation, possible need for interventions to maintain airway patency and ventilatory function, cardiovascular function is usually maintained
4	General Anesthesia	Depressed level of consciousness from which the patient is not easily roused, even with painful stimulation; probable inability to maintain ventilatory function and airway patency; positive pressure ventilation possibly required and possible depression of cardiovascular function

Results

Of the 300 recorded sedations, 270 cases (90%) were completed with no adverse events. Thirty (10%) "unplanned interventions or outcomes" were noted. Six "Minor" events were recorded, representing 20% of the unplanned interventions and outcomes and 2% of the total cases. Airway repositioning was performed 5 times (2%). Suctioning for emesis was noted in 1 case (0.3%). Twenty "Intermediate" unplanned interventions or outcomes were noted representing 69% of the unplanned events and 7% of the total cases. Of these, insufficient sedation (20 cases or 7%), provider dissatisfaction (20 cases or 7%), and abortion of treatment due to uncooperative behavior (10 cases or 3%) were recorded. No other intermediate level interventions were performed. No "Sentinel" interventions or outcomes were needed or observed.

Nausea without vomiting was reported in 2 (1%) cases. Vomiting occurred in 3 cases (1%). Active restraint was used in 4 cases (1%).

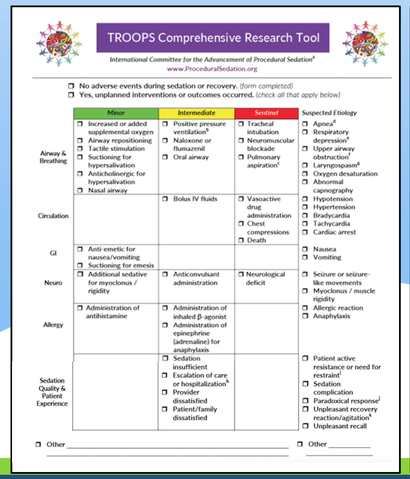
Both the average and median ages for the patient cohort was 6 years old. Of the 300 sedations, 293 were performed with the meperidine+hydroxyzine combination, and 7 were performed using a meperidine+hydroxyzine combination. The average sedation score was 1.6 for both the meperidine+hydroxyzine and diazepam+hydroxyzine groups. The meperidine+hydroxyzine group had a higher behavior score with a 3.8 as compared to 3.3 for the diazepam+hydroxyzine group, however the difference in means was not statistically significant with a Student's t-test (P=0.99) due to a difference in variance (0.26 vs. 0.82, respectively; P=0.005).

Conclusions

Because the current guidelines for continuous quality improvement remain relatively vague, the adoption of a standard form or tool for tracking sedation outcomes could prove beneficial for interested institutions and practitioners as well as for research purposes. The TROOPS tools may prove to be an acceptable option for CQI tracking. Both tools are designed to be used in any size facility and in any field that provides patient sedations[4]. In addition, the ease of use and efficiency of tool completion have been previously reported as an advantage in a study of nurse-administered sedation in cardiac catheterization laboratory patients[10]. Further research is warranted to evaluate interoperator reliability and agreement as well as identify whether modification to the TROOPS tools or the creation of a different standard instrument are needed.

The results of this study support that pediatric oral sedation for dental procedures, particularly with the meperidine+hydroxyzine or diazepam+hydroxyzine combinations, remains a relatively safe treatment modality with relatively minor associated complications. Further study with a greater number of diazepam+hydrozyxine patients might show a statistically significant difference in average behavior as compared to meperidine+hydroxyzine combinations.

The data also highlights one of the potential faults of enteral sedation techniques versus parenteral techniques, namely sedation reliability differences due to the slower, less predictable absorption and onset of action and the inability to easily titrate agents with the oral route thus resulting in failed or insufficient sedations.



TROOPS Comprehensive Research Tool

International Committee for the Advancement of Procedural Sedation
www.ProceduralSedation.org

☐ No adverse events during sedation or recovery. *(form completed)*
☐ Yes, unplanned Interventions or outcomes occurred. *(check all that apply below)*

	Minor	Intermediate	Sentinel	Suspected Etiology
Airway & Breathing	☐ Increased or added supplemental oxygen ☐ Airway repositioning ☐ Tactile stimulation ☐ Suctioning for hypersalivation ☐ Anticholinergic for hypersalivation ☐ Nasal airway	☐ Positive pressure ventilation[b] ☐ Naloxone or flumazenil ☐ Oral airway	☐ Tracheal intubation ☐ Neuromuscular blockade ☐ Pulmonary aspiration[c]	☐ Apnea[d] ☐ Respiratory depression[e] ☐ Upper airway obstruction[f] ☐ Laryngospasm[g] ☐ Oxygen desaturation ☐ Abnormal capnography
Circulation		☐ Bolus IV fluids	☐ Vasoactive drug administration ☐ Chest compressions ☐ Death	☐ Hypotension ☐ Hypertension ☐ Bradycardia ☐ Tachycardia ☐ Cardiac arrest
GI	☐ Anti-emetic for nausea/vomiting ☐ Suctioning for emesis			☐ Nausea ☐ Vomiting
Neuro	☐ Additional sedative for myoclonus / rigidity	☐ Anticonvulsant administration	☐ Neurological deficit	☐ Seizure or seizure-like movements ☐ Myoclonus / muscle rigidity
Allergy	☐ Administration of antihistamine	☐ Administration of inhaled β-agonist ☐ Administration of epinephrine (adrenaline) for anaphylaxis		☐ Allergic reaction ☐ Anaphylaxis
Sedation Quality & Patient Experience		☐ Sedation insufficient ☐ Escalation of care or hospitalization[h] ☐ Provider dissatisfied ☐ Patient/family dissatisfied		☐ Patient active resistance or need for restraint[i] ☐ Sedation complication ☐ Paradoxical response[j] ☐ Unpleasant recovery reaction/agitation[k] ☐ Unpleasant recall

☐ Other _____ ☐ Other _____

MINOR items pose little risk given appropriate sedation provider skills and monitoring.

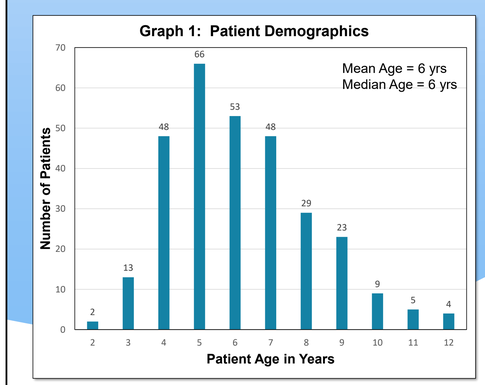
INTERMEDIATE items can endanger patients if not promptly managed, or reflect suboptimal sedation quality or patient experience and warrant timely reporting with peer scrutiny.

SENTINEL items are life-threatening and warrant immediate reporting and the highest level of peer scrutiny.

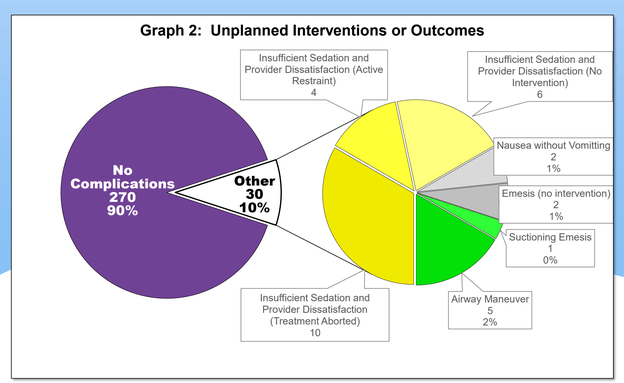
FOOTNOTES/DEFINITIONS

a. The goal of the Tracking and Reporting Outcomes Of Procedural Sedation (TROOPS) comprehensive research tool is to provide a standardized and practical tool to record procedural sedation adverse events, interventions, and outcomes. It is also possible that in specific clinical settings (e.g., newer sedation programs) it may be deemed appropriate to track some of these items for routine clinical practice. This tool is intended for use by all types of sedation providers in all locations and for patients of all ages. It was developed by multidisciplinary consensus from the *International Committee for the Advancement of Procedural Sedation* (www.proceduralsedation.org). Its elements can readily be incorporated into electronic medical records. TROOPS intentionally excludes timed event durations and specific thresholds (e.g., vital signs, oxygen desaturation, capnography) in favor of interventions and outcomes, which are more objective, clinically relevant, and more reliably recorded.
b. Positive pressure ventilation (PPV) includes bag-mask ventilation (BMV), bilevel positive airway pressure (BiPAP), continuous positive airway pressure (CPAP) and laryngeal mask airway (LMA).
c. Pulmonary aspiration is inhalation of oropharyngeal or gastric contents into the trachea during sedation or recovery and the appearance of new respiratory signs and symptoms.
d. Apnea is cessation of ventilatory effort.
e. Respiratory depression is decrease in ventilatory effort.
f. Upper airway obstruction is partial or complete obstruction of the upper airway responsive to airway positioning or oral/nasal airway placement.
g. Laryngospasm is partial or complete closure of the vocal cords that is not responsive to airway repositioning or oral/nasal airway placement.
h. Escalation of care includes significant prolongation of clinical care (including delayed discharge) or hospitalization due to sedation factors, including transfer to a higher level of care.
i. Need for restraint is more than minor physical restraint on more than one, brief occasion.
j. Paradoxical response is an unanticipated restlessness or agitation in response to sedatives.
k. Unpleasant recovery reaction/agitation is abnormal behaviors during the recovery stage of sedation (e.g., agitation, delirium, hallucinations) which are distressing to the patient or providers.

Graph 1: Patient Demographics



Graph 2: Unplanned Interventions or Outcomes



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