RETROSPECTIVE REVIEW OF DEEP INHALATIONAL SEDATION FOR PEDIATRIC ORAL SURGERY PATIENTS

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Introduction

Treating young patients with a poor behavior in the dental chair can be difficult and unsafe. We have previously investigated the use of deep inhalation Sevoflurane sedation for pediatric dental restorations. We found that this approach was not only safe and efficacious but also well-received by both parents and children, given the absence of the need for IV placement. Building upon this success, we have extended the application of this technique to short oral surgery procedures. Treatments that often necessitate the expertise of an Oral Surgeon (mostly complicated adult molar extractions, multiple orthodontic extractions). The current study adopts a retrospective design. Figures 1 and 2 show examples of this sort of anesthesia case. Using the BIS monitor, a multi-processed EEG, to indicate the depth of hypnosis/sedation, a BIS < 60 is consistent with general anesthesia. Sevoflurane & Nitrous concentration as well as clinical events are shown in these figures. Using our QA Sedation Airway Score we anticipate the airway scores assessments to fall within the standard range of 5-6 (Green), with 3-4 being considered acceptable (yellow) and 1-2 not acceptable (Red),consistent with our previous traffic light airway outcome report. The aim of this study was to review the efficacy and safety of deep inhalation Sevoflurane sedation with respect to sedation quality, procedure outcome and airway complications.

Methods

After IRB approval we retrospective reviewed the sedation records from Pediatric patients ages (4-17) years old who received inhalational sedation for OS at UPD between March 2023 and October 2023. General anesthesia was administered using a Drager Tiro anesthesia machine, comprehensive monitoring (using the GE B40 monitor with vapor analysis), and temperature monitoring. The anesthesia induction involved the administration of 2/4L O2/N2O and 8% Sevoflurane through a full-face mask. Subsequently, a small nasal mask with 6L 100% O2 and 8% Sevoflurane is used to maintain anesthesia during the procedure. The anesthesiologist ensured airway support through maneuvers such as chin lift, jaw thrust, and assisted bag mask ventilation, as necessary. On occasion, full mask support may be required. Data collection included patient's demographics, sedation outcomes, which includes procedure success, patient's behavior score and airway score and airway interventions required.
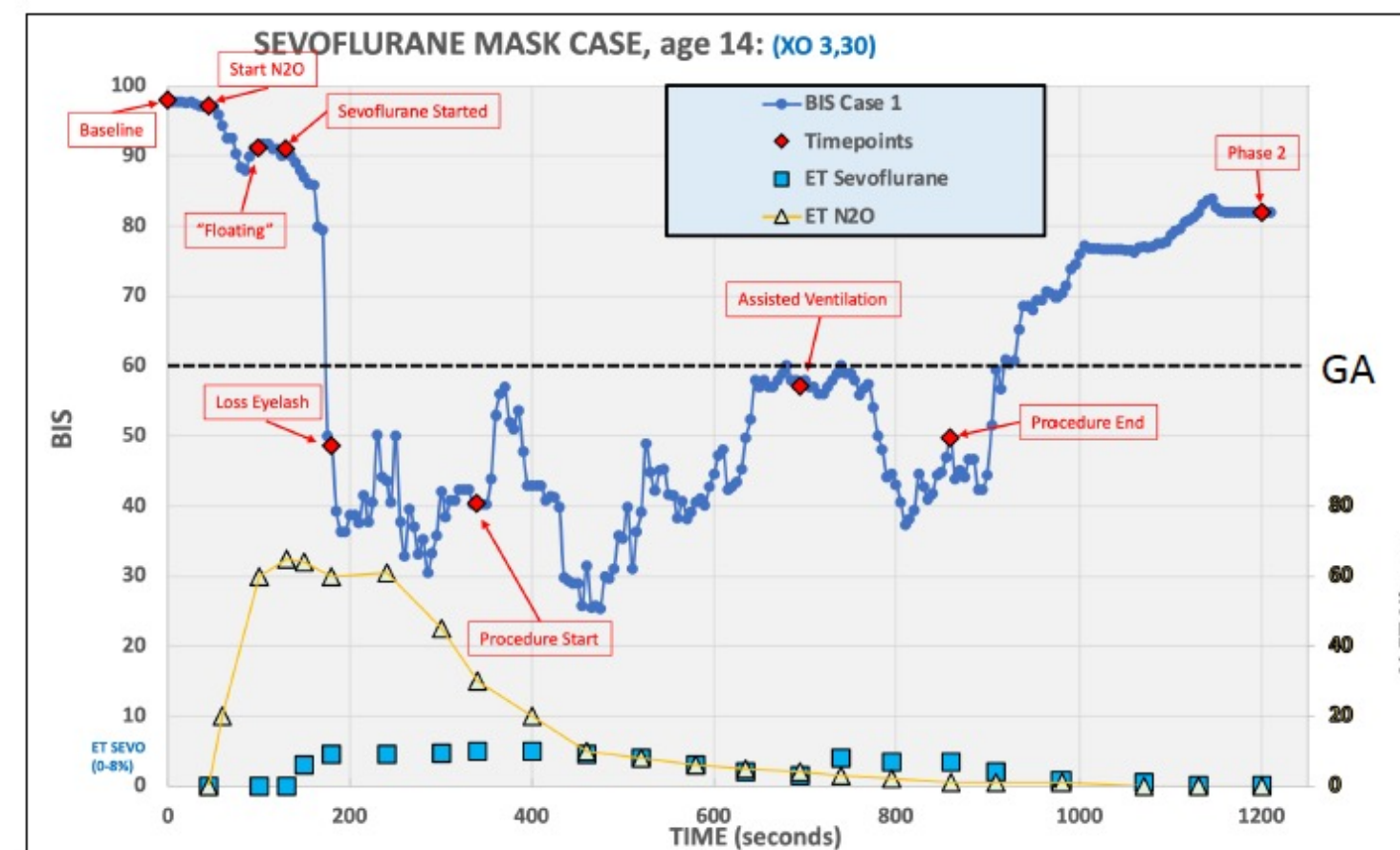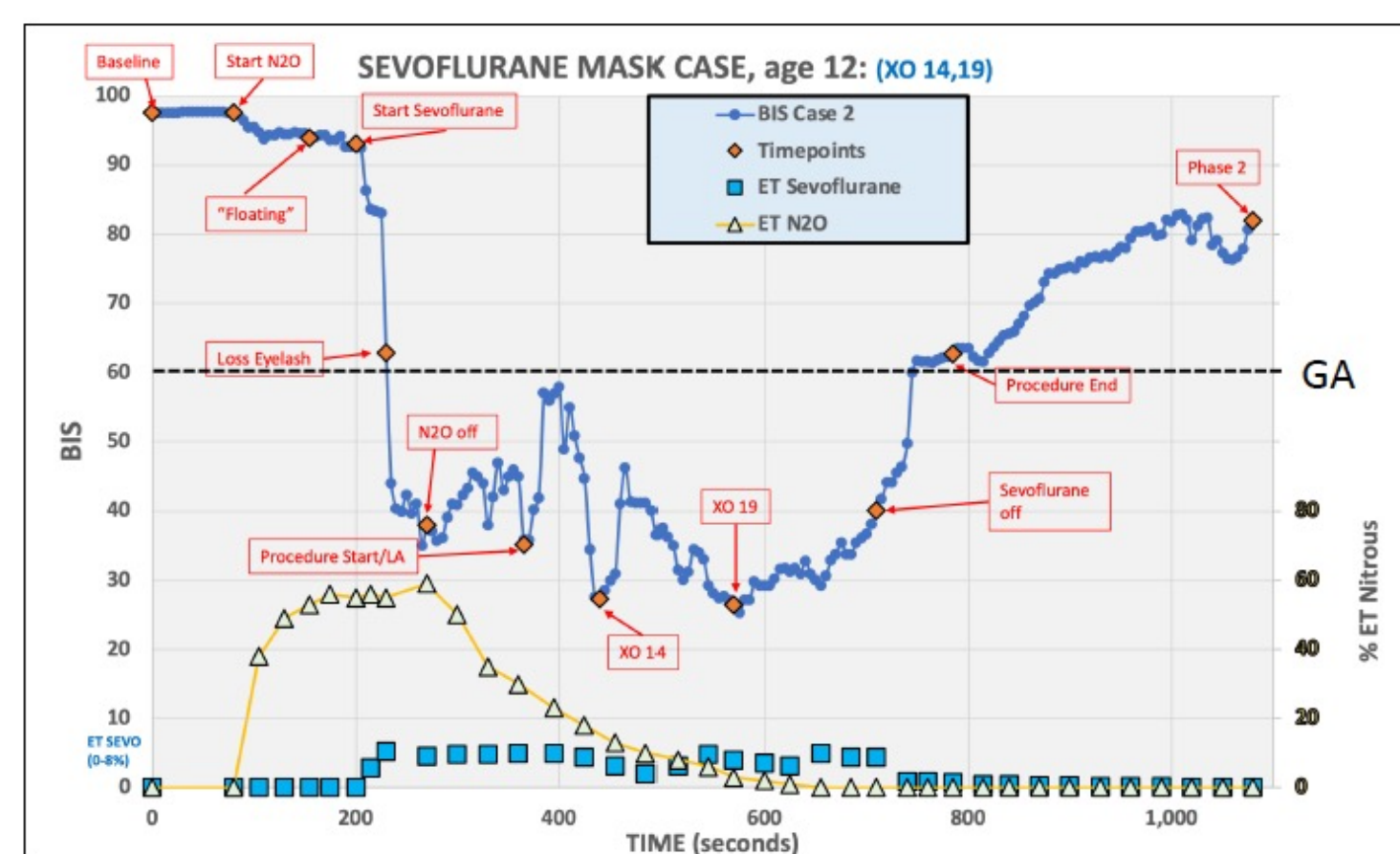
Figure 1

SEVOFLURANE MASK CASE, age 14: (XO 3,30)

Figure 2

SEVOFLURANE MASK CASE, age 12: (XO 14,19)

Results

We were able to review the charts from 121 OS children who underwent deep inhalational sedation procedures. The demographics as outlined in Tables 1 and 2, the average age was 11.5 years. For further analysis patients were divided into 3 groups based upon age; 5-9 years, 10 to 14 years and 15-17 years. The most common age range was 10-14 years. The average weight recorded was 47.9 kg, with an average BMI of 20.3. Notably, only 18% out of the 121 participants exhibited crying during N2O induction.

The procedure timing is shown in Table 3, the overall procedure times were very short. The average duration of Sevoflurane administration was 7.6 minutes, while N2O administration averaged 3.9 minutes and procedure duration averaging 4.4 minutes. The average Airway score and Behavior score were 4.7 and 9.9, respectively, consistent with airway management for deep sedation and good outcomes. As shown in Table 4, adequacy of respiration was assessed when using the nasal mask through capnography and bag movement. A good (mostly/all) assessment was possible in about ~70% of the cases. In Table 5, airway interventions: 100% of cases required 100% O2 and repeated chin lift. 0% required ETT/LMA placement or deeper sedation or paralysis for management of laryngospasm. We also had a 100% case completion rate. As such our traffic light outcomes were good with 83.5% in the Green zone, 16.5 in the yellow zone and no patients in the Red zone.

Discussion

The results indicate that Sevoflurane, utilized as deep inhalation sedation, represents a promising and safe option for sedating young patients undergoing either single complicated extractions or multiple orthodontic procedures. These findings suggest that the efficacy and safety of Sevoflurane are comparable to those observed in our previous study involving pediatric patients undergoing dental restorations. Notably, this is evidenced by favorable, no (red) airway and excellent behavior scores, along with no need for emergency interventions such as intubation / LMA. One of the concerns for this non instrumented, no IV placement sedation technique is the risk of airway complications, especially laryngospasm. So far, we have completed over 800 cases in the past 2 years without any need for IV placement nor airway instrumentation; statistical analysis shows the 95% CI for these sort of complications is between 0 and 0.3%, very low. A pediatric anesthesiologist is always in full attendance for these cases. Rarely an Oral airway is used and mostly during the induction of anesthesia, also ventilation assist was mostly required to ensure adequate end-tidal Sevoflurane rather than to manage desaturation. This sedation method holds considerable appeal for both parents and young patients as it eliminates the necessity for intravenous placement. This aspect is particularly significant as it contributes to patient comfort and ensures a lack of memory of the operative procedure, thereby mitigating the development of dental fear. In addition, the rapid recovery ensures a "short" visit to the surgeon's office.

Table 1. Overall Demographics

Descriptive	AGE	WEIGHT	BMI	MP	TONSIL
AVERAGE	11.5	47.9	20.3	1.2	1.4
STD DEV	3.1	17.5	5.0	0.4	0.6
MEDIAN	11	45.2	19.15	1	1
MIN	5	20	12.9	1	0
MAX	24	108	37.5	3	3

Table 2. Demographics by Age Group

Age Groups	NUMBER	AVE WT	AVE BMI	% CRY N2O
5 to 9 years	31	34.4	18.3	3
10 to 14 years	69	48.6	20.6	1
15 years plus	21	65.8	22.5	14

Table 3. Sedation & Procedure Times, Outcome Scores

Descriptive	TIME SEVO	TIME NITROUS	PROC TIME	PHASE 2	DC TIME	AIR SCORE	BEH SCORE
AVERAGE	7.6	3.9	4.4	6.8	21.5	4.7	9.9
STD DEV	3.2	1.1	3.6	2.3	2.5	0.7	0.3
MEDIAN	7	4	3	6	20	5.0	10.0
MIN	3	1	0	1	20	3.0	8.0
MAX	20	8	17	16	32	6.0	10.0

Age Groups	TIME SEVO	TIME NITROUS	PROC TIME	PHASE 2	DC TIME	% 1 PROC	% 2 PROC
5 to 9 years	7.7	3.7	4.6	6.7	22.1	60.3	24.8
10 to 14 years	7.9	4.0	4.7	6.8	21.5	**% 3 PROC**	**% 4 PROC**
15 years plus	6.5	3.7	3.1	7.3	20.6	9.9	5.0

Table 4. Assessment Respiration with Nasal Mask

% CASES	NONE	OCCCASIONAL	~ 50% TIME	MOSTLY/ALL
CAPNOGRAPHY	5.0	14.1	19.9	58.9
BAG MOVEMENT	3.3	11.6	19.1	64.7
IMPEDANCE RESPIRATORY MONITOR THROUGHOUT PROCEDURE FROM THE EKG				
TIDAL VOLUME MONITOR: REQUIRES GOOD MASK SEAL AND TV > 20 ML				

Table 5. Airway Interventions by Age Group

% CASES	O2 100%	REPEAT CHIN	FORCE JAW	REPEAT JAW	INCOMP-LETE	AIRWAY	BMV	ETT / LMA	DEEP SPASM	SUX SPASM
All Patients	100	100	6.6	5	0	0	11	0	0	0

AGE GROUPS	O2 100%	REPEAT CHIN	FORCE JAW	REPEAT JAW	INCOMP-LETE	AIRWAY	BMV	ETT / LMA	DEEP SPASM	SUX SPASM
5 to 9 years	100	100	13	10	0	0	10	0	0	0
10 to 14 years	100	100	4	4	0	0	13	0	0	0
15 years plus	100	100	5	0	0	0	5	0	0	0