Post-Discharge Events Occurring after Dental Treatment under Deep Sedation in Pediatric Patients

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Purpose: *Deep sedation is often required in dentistry for treating children with uncooperative behavior. We assessed immediate post-sedation events during the first 24 hours after dental treatment under deep sedation in children, and examined correlations to a number of variables.* ***Study design***: *Information was collected from medical files for a convenience sample of children between the ages of 1 and 16, who were treated under deep sedation at one clinic (propofol alone or combined with a sedative agent). Parents were interviewed by telephone regarding the first 24 hours following treatment.*

Results: *Among 32 children under age 6 years, 26 (81.3%) had at least one post sedation complication, compared to 19/22 (86.4%) aged 6 and older, p>0.05. According to parent report, 13 (59.1%) of the older children had pain, compared to 6 (18.8%) of the younger ones, p=0.002. For no patient in the younger group compared to 18.2% in the older group was dizziness reported as a complication, p=0.023. Among those who received a sedative agent, 93.3% had one or more complications; 26.7% had nausea or vomiting. The respective rates were 79.5% and 5.1% among those treated only with propofol.* ***Conclusions***: *Though safe, deep sedation poses complications and adverse events.*

Key words: *deep sedation, dental treatment, post-discharge events, children.*

INTRODUCTION

According to the American Society of Anesthesiologists and to the National Institute for Clinical Health and Care Excellence (NICE), deep sedation is a drug-induced depression of consciousness during which patients are asleep and cannot be easily roused but do respond purposefully to repeated or painful stimulation.[1] The ability to independently maintain ventilatory function may be impaired. Patients may require assistance to maintain a patent airway. Spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained.

Deep sedation in dentistry is often required for treating children with uncooperative behavior. This is especially true under conditions that limit the effectiveness of behavior management techniques such as cognitive impairment, developmental delay, and precooperative age.[2] In a study conducted in India both propofol and midazolam were found to be effective as intravenous sedative agents for short pedodontic procedures with minimal side effects, in the management of uncooperative children who are American Society of Anesthesiology (ASA) I, aged 2-5 years.[3] A British study found intravenous midazolam sedation to be a safe and effective method of sedation for use in children and adolescents. The side effects observed in their study included crying, drowsiness, and amnesia.[4] A large U.S. study reported that propofol sedation is safe for pediatric use, provided that a medical system manages the less serious events.[5]

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During the first 24 hours after discharge from the treatment facility, post-sedation events may occur in children sedated for dental treatment. For pediatric dentists and children's parents, awareness of post sedation physiological and behavioral side effects is important, as is the understanding of variables that may be associated with side effects. The aim of this study was to assess immediate post-sedation events during the first 24 hours after dental treatment under deep sedation in children, and to examine correlations to a number of variables.

MATERIALS AND METHOD

The Hadassah Human Subjects Institutional Board approved this study, which was performed in a convenience sample of children between the ages of 1 and 16, who were treated under deep sedation with intravenous drugs/anesthetic agents (propofol alone or combined with one of the sedative agents: midazolam or ketamine) at the post-graduate dental clinic of the Department of Pediatric Dentistry of the Hadassah School of Dental Medicine, between May 5, 2012 and October 2, 2014.

Eligibility criteria for inclusion in the study were ASA Class I or II and uncooperative behavior due to cognitive impairments, developmental delay, or young age; conditions that do not afford the use of behavior management techniques.

Treatment complexity was defined as simple (examination, dental x-rays, prophylaxis, fissure sealants, Class I, Class II restorations) and complex (stainless steel crowns, strip crowns, pulp therapy, dental extractions, biopsy). Treatments were classified by duration: up to 60 minutes and above 60 minutes.

Information on children's medical conditions and dental procedures was collected from medical files. At least one year and up to 2 years after the treatment, parents were asked by phone about their memory of post discharge events during the first 24 hours following the treatment. The following post discharge effects were included in the phone questionnaire: restlessness, crying, sleepiness, dizziness, insomnia, fever, nausea or vomiting, pain in the oral cavity, pain in other parts of the body, incontinence, change in urination frequency, lack of appetite, and any other adverse effect. In addition, the parents were asked if there was any need to contact the hospital and if their child remembered the dental treatment.

Statistical analysis

Frequencies and percentages were calculated for categorical variables. The frequencies of categorical variables by study groups were analyzed with the Chi square test (a parametric test) or Fisher-Irwin exact test (a non-parametric test for small samples). Means, standard deviations and ranges were calculated for continuous variables. Continuous variables were compared between the study groups using the 2 sample T-test for differences in means. All statistical tests are analyzed to a significance level of 0.05.

RESULTS

The study population comprised 54 children mean age 6.1±4.3 years old, 29 boys and 25 girls. Of them, 74% were ASA I and 26% ASA II. For analysis, the children were divided into 2 age groups: 32 under age 6 years and 22 aged 6 years or older.

Thirty-nine children were treated under propofol alone, while 15 were sedated with propofol in combination with other sedative agents (midazolam or ketamine). Propofol alone was administered to 78.1% of the children under the age of 6 and 63.6% of the children aged 6 years and older. This difference was not statistically significant.

Average treatment duration was 52.9±13.3 minutes (range 30-90 minutes) in the young group and 57.9±13.7 (range 38-91 minutes) in the older group.

The complexity of the treatments in the young group was 9.4% simple and 90.6% complex, while in the older group 18.2% were simple and 81.8% complex.

Complication analysis by age group

Results of the statistical analysis for post sedation complications by the two age groups (below age 6 and age 6 and above) are presented in Table 1. In the younger group, 81.3% had at least one post sedation complication, compared to 86.4% in the older group. The difference is not statistically significance (p>0.05).

More than half (59.1%) of the parents interviewed in the older group reported that their children had pain in the oral cavity, compared to only 18.8% in the younger group. This difference is statistically significant (p=0.002). For no patient in the younger group compared to 18.2% in the older group was dizziness reported as a complication. This difference is statistically significant (p=0.023). No other statistically significant differences were observed between the age groups in any of the other complications assessed by parent report.

Table 1 Types of complications by age groups

Complication	All (n=54)	< 6 years (n=32)	≥ 6 years (n=22)	p value
Yes	45 (83.3)	26 (81.3)	19 (86.4)	⊥0.723
No	9 (16.7)	6 (18.7)	3 (13.6)	
Complication Type				
Sleepiness	34 (63.0)	20 (62.5)	14 (63.6)	⊦0.932
Memory of the dental visit	25 (46.3)	15 (46.9)	10 (45.5)	⊦0.918
Crying	24 (44.4)	16 (50.0)	8 (36.4)	⊦0.322
Restlessness	19 (35.2)	13 (40.6)	6 (27.3)	⊦0.313
Pain in the oral cavity	19 (35.2)	6 (18.8)	13 (59.1)	⊦**0.002**
Lack of appetite	16 (29.6)	11 (34.4)	5 (22.7)	⊦0.357
Insomnia	7 (13.0)	4 (12.5)	3 (13.6)	⊥1.000
Fever	6 (11.1)	5 (15.6)	1 (4.6)	⊥0.383
Nausea, Vomiting	6 (11.1)	2 (6.3)	4 (18.2)	⊥0.211
Dizziness	4 (7.4)	0 (0)	4 (18.2)	⊥**0.023**
Incontinence	1 (1.9)	0 (0)	1 (4.6)	⊥0.407
Contacting the hospital	1 (1.9)	1 (3.1)	0 (0)	⊥1.000

Data are numbers (%); P value comparing younger and older groups by ⊦chi square test or ⊥Fisher exact test; **p≤0.05** (Sig); p>0.05 (NS)

Complication analysis by anesthetic agent group

Results of the statistical analysis for post sedation complications by the two anesthetic agent groups (propofol alone vs. propofol combined with other sedative combinations) are presented in Table 2. The proportion of patients in the propofol alone group who had one or more complications, according to parent report, was lower than in the sedative combination group, 79.5% vs. 93.3%. The difference did not reach statistical significance (p>0.05).

The percentage of patients with nausea or vomiting complications in the sedative combination group (26.7%) was higher than in the propofol group (5.1%). The difference was statistically significance (p=0.044). No other statistically significant differences were observed, according to type of anesthesia, in any of the other complications assessed by parent report.

Table 2 Types of complications according to type of anesthesia

Complications	Propofol (n=39)	Sedative combination (n=15)	p value
Yes^	31 (79.5)	14 (93.3)	⊥0.4170
No	8 (20.5)	1 (6.7)	
Type of complication			
Sleepiness	22 (56.4)	12 (80.0)	⊦0.1080
Memory of the dental visit	19 (48.7)	6 (40.0)	⊦0.5650
Crying	15 (38.5)	9 (60.0)	⊦0.1540
Restlessness	13 (33.3)	6 (40.0)	⊦0.6460
Pain in the oral cavity	13 (33.3)	6 (40.0)	⊦0.6460
Lack of appetite	11 (28.2)	5 (33.3)	⊦0.7120
Insomnia	6 (15.4)	1 (6.7)	⊥0.6590
Fever	5 (12.8)	1 (6.7)	⊥1.0000
Nausea, Vomiting	2 (5.1)	4 (26.7)	⊥**0.0440**
Dizziness	1 (2.6)	3 (20.0)	⊥0.0600
Incontinence	0 (0)	1 (6.7)	⊥0.2780
Contacting the hospital	1 (2.6)	0 (0)	⊥1.0000

Data are numbers (%); ^One or more complications

P value by Propofol alone vs. other combination by ⊦chi square test or ⊥Fisher exact test; p≤0.05 (Sig); p>0.05 (NS)

Clinical data and complication existence

For patients with complications (N=45), the mean duration procedure time was 55.4±14.0 minutes and the proportion of complex procedures was 86.7% (39/45). For patients without complications (N=9), the mean duration procedure time was 52.8±11.8 (N=9) and the proportion of complex procedures was 88.9% (8/9).

DISCUSSION

One of the challenges facing pediatric dentists is treating children who are uncooperative due to cognitive impairments, developmental delay, or young age; conditions that do not afford the use of behavior management techniques. Therefore, deep sedation is a well-accepted technique.

In this study we evaluated the immediate and late discharge complications of deep sedation according to parent report. The patients were discharged according to AAPD guidelines.[1] We investigated parents' recall about complications occurring within 24 hours of sedation.

We found that dental treatment under deep sedation is safe; however, certain post discharge complications need be considered, which are not related to the age of the child. Sleepiness, memory of dental visit, crying, restlessness and pain in the oral cavity were the most common discharge events. Insomnia, fever, nausea and vomiting and dizziness were less common but were reported in about 10% of the children. Regarding the overall complications, parents of most of the children in both groups reported at least one post sedation complication.

A statistically significant difference was found, according to age, regarding pain in the oral cavity; more than half of the children in the older group presented this complication. In a study conducted by Ozer *et al*, greater agitation was observed after procedures involving extractions than those involving restorative procedures,[6] but the difference was not statistically significant. Therefore our results are in accordance with their findings. We assume that children in the older group of the current study could report to their parents more accurately their pain than younger children. Dossani *et al* reported that post-discharge sleepiness, drug-specific motor imbalance, sleep during transit, and recovery time greater than four hours were common and warrant vigilant adult supervision.[7] They did not report pain in the oral cavity after treatment.

Martinez and Wilson reported that 20% of children aged 2-5 years old reported pain after treatment under conscious sedation. In our study we found that the report of pain was similar for the same age group and higher among children aged 6 years and older.[8] During dental treatment under conscious and deep sedation, children received local anesthesia according to their body weight. This limits the amount of work that can be performed in one session in young children. We assume that the amount of treatment performed was similar in ours and Martinez's study. In the current study, the more frequently reported pain by parents of children aged 6 years and older may be due to the greater amount of work performed in one session and the capability of more accurate reporting.

In a study conducted by von Baeyer CL *et al***,** the youngest children provided inaccurate high pain ratings before surgery. However, they were similar to older children in the accuracy of their pain ratings for the remainder of the 3-day study period.[9] This suggests that direct experience with pain or with the rating task may improve accuracy. In that study children aged 3-7 years old were assessed. A Face Pain Scale was used, while we relied on parent report only.

In another study, 5- and 6-year-old children were found to be significantly more accurate in their use of the Face Pain Scale in response to the vignettes presented them than 4-year-old children, who in turn were significantly more accurate than 3-year-old children.[10]

In our study young children did not report dizziness after treatment while about 20% of the older children did report such. This may be due to the fact that young children cannot explain what dizziness is and they were taken in strollers and their parents did not realize that this was a complication.

Most of the children in our study (72.2%) were sedated with propofol only while 27.8% were sedated with either midazolam or ketamine in combination with propofol. Nausea and vomiting was the only complication that was significantly more frequent among those who received combined sedative agents. This may be attributed to the ketamine used in the combination. This is in accordance with Alletag *et al's* study that found that vomiting with ketamine administration, was a frequent adverse effect, with a reported incidence ranging from 7% to 26%.[11] Vomiting was also idiosyncratic and did not seem to be dose related.

Our telephone questionnaire was performed at least one year after treatment. Though we assumed that parents would remember unusual events related to the sedation or to the dental procedure, reporting bias is a limitation of the study.

Surprisingly, in this study, the duration and complexity of treatment of the procedures did not affect the appearance of post discharge complications. A single experienced pediatric dentist performed all the treatments. It seems that for one hour treatments, complication rates do not differ according to difficulty of treatment.

CONCLUSIONS

1. Sleepiness is the most common post discharge event observed in children undergoing dental treatment under deep sedation.
2. After dental treatment with deep sedation, children may display crying, restlessness, or lack of appetite, and may recall the dental visit.
3. After treatment, older children report more pain in the oral cavity than do younger children.

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