

INTRODUCTION

Pediatric dentistry requires effective management of patients' behavior to ensure successful completion of dental procedures. Basic behavior guidance techniques such as tell-show-do, positive reinforcement, distraction, voice control, parental presence/absence, and nitrous oxide are commonly used. However, these techniques may not be sufficient to manage the behavior of uncooperative patients, particularly those with medical conditions, situational anxiety, or young age. In such cases, advanced behavior guidance techniques such as protective stabilization, sedation, and general anesthesia may be necessary.

The American Academy of Pediatrics (AAP) and the American Academy of Pediatric Dentistry (AAPD) have endorsed guidelines for the elective use of conscious sedation, deep sedation, and general anesthesia in pediatric patients since 1985. The guidelines aim to ensure safe, effective, and reproducible sedation that enhances the experience of both patients and providers. Various levels of sedation exist, ranging from minimal sedation to general anesthesia, with minimal and moderate sedation being the safest options in everyday practice. At Nicklaus Children's Hospital Dental Department, Hydroxyzine, Midazolam, and Diazepam are commonly used to achieve desired levels of sedation.

The primary objective of this study is to evaluate the quality of sedation performed on dental patients at Nicklaus Children's Hospital by assessing their behavior during treatment. Limited research exists comparing the efficacy of Hydroxyzine, Midazolam, and Diazepam as sedatives in the dental setting. Through analysis of the collected data, this study aims to better predict the behavioral outcomes of patients during sedation appointments. This, in turn, will improve the quality of sedations and lead to better experiences for both patients and providers.

METHODS

This study employed a retrospective chart review to analyze the efficacy of dental sedation in pediatric patients aged between 3-11 years, who were classified as American Society of Anesthesiologists (ASA) physical status I or II, and received dental sedation between November 1, 2018, and May 1, 2022, at Nicklaus Children's Hospital Dental Residency. The sedation was administered by 1st and 2nd year dental residents, who utilized one of three sedative medications (oral Hydroxyzine, Midazolam, or Diazepam), in combination with nitrous oxide, with medication dosages calculated based on patient weight at the time of treatment. The patient charts were allocated into three groups at a 1:1:1 ratio to ensure equal distribution. The effectiveness of sedation was evaluated using Frankl's Behavior Rating Scale, which is consistent with the guidelines outlined in The Handbook of Pediatric Dentistry, 5th Edition (2018).

RESULTS

Sex	Frequency	Percent	Mean Age
F	92	51.1%	6 years, 2 months
M	88	48.9%	6 years, 4 months

Sex	Count	Behavior Pattern				Total
		Frankl 1	Frankl 2	Frankl 3	Frankl 4	
F	20	52	7	13	92	
	% within Sex	21.7%	56.5%	7.6%	14.1%	100.0%
	% of Total	11.1%	28.9%	3.9%	7.2%	51.1%
M	24	51	9	4	88	
	% within Sex	27.3%	58.0%	10.2%	4.5%	100.0%
	% of Total	13.3%	28.3%	5.0%	2.2%	48.9%
Total	Count	44	103	16	17	180
	% of Total	24.4%	57.2%	8.9%	9.4%	100.0%

Medication Type	Count	Restoration Type				Total
		Composite	SSC	SC	EXT	
Hydroxyzine	40	47	12	22	121	
	% within Medication Type	33.1%	38.8%	9.9%	18.2%	100.0%
	% of Total	12.2%	14.3%	3.6%	6.7%	36.8%
Midazolam	32	37	8	22	99	
	% within Medication Type	32.3%	37.4%	8.1%	22.2%	100.0%
	% of Total	9.7%	11.2%	2.4%	6.7%	30.1%
Diazepam	37	42	6	24	109	
	% within Medication Type	33.9%	38.5%	5.5%	22.0%	100.0%
	% of Total	11.2%	12.8%	1.8%	7.3%	33.1%
Total	Count	109	126	26	68	329
	% of Total	33.1%	38.3%	7.9%	20.7%	100.0%

Medication Type	Count	Behavior Pattern				Total
		Frankl 1	Frankl 2	Frankl 3	Frankl 4	
Hydroxyzine	7	48	1	4	60	
	% within Medication Type	11.7%	80.0%	1.7%	6.7%	100.0%
	% of Total	3.9%	26.7%	.6%	2.2%	33.3%
Midazolam	17	32	6	5	60	
	% within Medication Type	28.3%	53.3%	10.0%	8.3%	100.0%
	% of Total	9.4%	17.8%	3.3%	2.8%	33.3%
Diazepam	20	23	9	8	60	
	% within Medication Type	33.3%	38.3%	15.0%	13.3%	100.0%
	% of Total	11.1%	12.8%	5.0%	4.4%	33.3%
Total	Count	44	103	16	17	180
	% of Total	24.4%	57.2%	8.9%	9.4%	100.0%

Behavior Pattern	Age	
Frankl 1	Mean	6 years, 5 months
	Std. Deviation	2 years, 2 months
Frankl 2	Mean	6 years, 1 month
	Std. Deviation	2 years, 0 months
Frankl 3	Mean	6 years, 3 months
	Std. Deviation	1 year, 10 months
Frankl 4	Mean	6 years, 10 months
	Std. Deviation	2 years, 5 months
Total	Mean	6 years, 3 months
	Std. Deviation	2 years, 1 month

DISCUSSION

51.1% of patients were female whereas 48.9% were male. Females exhibited positive behavior 11.1% of the time compared to 7.2% for males. Both of these values are considerably low. A study published in the Journal of Child Development found that girls tend to exhibit more self-control and compliance with rules than boys at age 6. Therefore, it's possible that females exhibited better behavior in our study based on this maturity level.

When comparing age groups, patients who exhibited Frankl 4 behavior were on average 6 years 10 months old compared to 6 years 5 months for Frankl 1. Although this is not a significant age difference between the two groups, it's understandable that the older patient would perform better since they're likely more mature.

When comparing types of treatment completed, there doesn't appear to be many differences between the medications. The table titled "Restoration Type" represents whether a specific procedure was able to be completed with each medication but doesn't take into account how many of each procedure was performed in the given appointment. Since all three medications had similar treatments performed during their respective sedation appointments, treatment type should not be considered a factor in which medication produced better behavior overall.

All three medications, when used individually, most commonly demonstrated a negative, reluctant, timid, uncooperative behavior (Frankl 2, 57.2%). The next most common behavior for all three individual medications was definitely negative, refusal of treatment, defiant, and unable to cooperate throughout (Frankl 1). Although there were significant differences between all three medications, the overall low rate of positive behavior demonstrates that these drugs are not having the desired effect or outcome. Some of the medication dosing was based on patients' ideal weights, so it's possible that these patients might have been more sedated had they received higher doses. The average administered oral dose of each medication in this study was 3.26 mg/kg for Hydroxyzine, 0.47 mg/kg for Midazolam and 0.22 mg/kg for Diazepam. It shouldn't be ignored that 18.3% of the time there was some positive behavior (Frankl 3+4). These results likely would have been different had the patients not been sedated.

The most effective sedation medication was Diazepam, which had overall positive behavior (Frankl 3+4) 28.3% of the time. Diazepam also had the highest percentage of patients in the (Frankl 3) and (Frankl 4) group respectively. The group that demonstrated the worst behavior was the Hydroxyzine group, which had overall negative behavior (Frankl 1+2) 91.7% of the time. This is to be expected because Hydroxyzine is most often used in combination with other sedative drugs. None of the medications used provide an analgesic effect, which might also be a factor in the low amount of overall positive behavior.

CONCLUSIONS

The administration of Hydroxyzine, Midazolam, and Diazepam orally resulted in significant differences in behavior during dental sedation procedures. However, all three medications demonstrated poor performance in eliciting positive behavior overall. A larger sample size with a blinded single provider could help obtain more unbiased results in future studies. These findings can guide dental practitioners in selecting the most effective sedation medication for their patients to ensure a positive and comfortable dental experience.