

# Adverse Events of Dental Treatment Under Sedation or General Anesthesia

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## INTRODUCTION

Current literature for pediatric patient safety during dental procedures is lacking. The majority of current knowledge in the areas of patient safety during oral conscious sedation (**OCS**) and general anesthesia (**GA**) come from medical specialties outside of dentistry. There is some debate in the scientific literature regarding the type of local anesthesia recommended during pediatric full mouth dental rehabilitation procedures performed under general anesthesia.<sup>1,2</sup> Of particular interest are the occurrence of hypoxemia in relation to obesity during OCS, incidence of hypotension in relation to use of local anesthesia with epinephrine during GA, and comparing post operative pain experienced with different local anesthetics used during GA.

Hypoxemia is the most common and critical unplanned cardiopulmonary adverse complication of sedatives and analgesic drugs due to depression of respiratory drive and hypoventilation.<sup>3</sup> Overweight adults are more likely to develop hypoxia because of reduced functional residual capacity which is further reduced by sedation.<sup>4</sup> Since the 1980s the population of overweight children ages 6- to 11-year-old has nearly quadrupled in the United States and the levels of obesity have reached epidemic proportions around the world.<sup>5</sup> Therefore, with the increasing rates of childhood obesity, the incidence of hypoxemia during sedation is expected to rise.

Lidocaine is a cardiac depressant and the necessity of its use during GA has been debated. Some advocate the use of local anesthetic during GA to provide intra- and postoperative advantages for hemostasis and pain management, while others argue it is an unnecessary risk factor that could lead to adverse complications such as cardiac depression during surgery or lip bite trauma post-surgery.<sup>1,2</sup>

Pain is defined as “an unpleasant subjective experience that is the product of both emotional and sensory components interrelated with the context of culture and environment.”<sup>6</sup> According to the article titled “Use of local anesthesia during dental rehabilitation with general anesthesia,” about 40% of dental anesthesiologists prefer to use local anesthesia with general anesthesia for several reasons including; stabilization of vital signs and avoidance of deep pain pathways.<sup>7</sup> Two anesthetics commonly used by dental practitioners are 2% lidocaine and 4% Articaine. Kambalimath has indicated that “4% Articaine has a longer duration of action and superior diffusion through bony tissue.”<sup>8</sup> Based on this information, it can be hypothesized that due to greater depth of anesthesia and longer duration of action of Articaine, patients may experience less post-operative pain when 4% Articaine is given.

## PURPOSE

This study sought to explore hypotension in children with, compared to those without lidocaine 2% 1:100,000 epinephrine local anesthetic (LA) treated under GA, the link between oxygen saturation (O<sub>2</sub>S) below 90% and children’s BMI classification during treatment under OCS, and post-operative pain between children administered lidocaine LA compared to Articaine during treatment under GA.

It was hypothesized that the use of lidocaine 2% 1:100,000 epinephrine would increase the occurrence of hypotension in children being treated for full mouth dental rehabilitation under GA, that increased BMI would have a positive correlation with oxygen desaturation during OCS, and that the use of Articaine during GA would result in reduced post operative pain following GA when compared to lidocaine.

## TABLE 1. DEMOGRAPHIC CHARACTERISTICS

	Overall	Minimal SED	Moderate SED	Deep SED	GA	p-value
n	2484	174	1199	7	##	
Child's age in years; mean (sd); Ordinal						0
Less than 1	15 (0.6)	0 (0.0)	1 (0.1)	0 (0.0)	14 (1.3)	
1 to less than 2	178 (7.2)	8 (4.6)	87 (7.3)	2 (28.6)	81 (7.3)	
2 to less than 3	453 (18.2)	34 (19.5)	216 (18.0)	2 (28.6)	201 (18.2)	
3 to less than 4	647 (26.0)	51 (29.3)	291 (24.3)	1 (14.3)	304 (27.6)	
4 to less than 5	675 (27.2)	46 (26.4)	318 (26.4)	2 (28.6)	311 (28.2)	
5 to less than 6	516 (20.8)	35 (20.1)	288 (24.0)	0 (0.0)	192 (17.4)	
6 to less than 7	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Sex (%); Nominal						1
Male	1296 (52.2)	93 (53.4)	610 (50.9)	3 (42.9)	589 (53.4)	
Female	1187 (47.8)	81 (46.6)	588 (49.0)	4 (57.1)	514 (46.6)	
Other	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
No response	1 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)	
Child's Race/Ethnicity n (%); Nominal						<0.001
Hispanic	879 (35.4)	80 (46.0)	464 (38.7)	2 (28.6)	332 (30.1)	
White, Non-Hispanic	522 (21.0)	41 (23.6)	225 (18.8)	4 (57.1)	252 (22.8)	
Black or African American, Non-Hispanic	441 (17.8)	31 (17.8)	178 (14.8)	1 (14.3)	231 (20.9)	
American Indian or Native Alaskan, Non-Hispanic	300 (12.1)	2 (1.1)	170 (14.2)	0 (0.0)	128 (11.6)	
Asian, Non-Hispanic	48 (1.9)	1 (0.6)	28 (2.3)	0 (0.0)	19 (1.7)	
Native Hawaiian or Other Pacific Islander, Non-Hispanic	6 (0.2)	1 (0.6)	3 (0.3)	0 (0.0)	2 (0.2)	
Two or more races, Non-Hispanic	7 (0.3)	0 (0.0)	2 (0.2)	0 (0.0)	5 (0.5)	
No response	281 (11.3)	18 (10.3)	129 (10.8)	0 (0.0)	134 (12.1)	
ASA Classification; n (%); Nominal						<0.001
ASA 1	2065 (83.2)	166 (95.4)	1048 (87.4)	4 (57.1)	847 (76.8)	
ASA 2	405 (16.3)	8 (4.6)	149 (12.4)	3 (42.9)	245 (22.2)	
ASA 3	13 (0.5)	0 (0.0)	2 (0.2)	0 (0.0)	11 (1.0)	
Payor Source; n (%); Nominal						<0.001
Medicaid	2213 (89.1)	160 (92.0)	1053 (87.8)	7 (100.0)	992 (89.9)	
Children's Health Insurance Program (CHIP)	10 (0.4)	1 (0.6)	4 (0.3)	0 (0.0)	5 (0.5)	
Commercial Insurance	99 (4.0)	7 (4.0)	53 (4.4)	0 (0.0)	39 (3.5)	
No Insurance	68 (2.7)	4 (2.3)	62 (5.2)	0 (0.0)	2 (0.2)	
Multiple insurance coverage	38 (1.5)	2 (1.1)	21 (1.8)	0 (0.0)	15 (1.4)	
No response	56 (2.3)	0 (0.0)	6 (0.5)	0 (0.0)	50 (4.5)	

## TABLES 2, 3 & 4

Table 2. Prevalence of hypotensive events between local anesthesia with and without lidocaine for children treated under General Anesthesia

	General Anesthesia			p-value
	Overall	Lidocaine	No lidocaine	
n	1103	814	276	
Hypotension				0.165
Yes	1 (0.1)	0 (0.0)	1 (0.4)	
No	1098 (99.6)	813 (99.9)	274 (99.3)	
No response	3 (0.3)	1 (0.1)	1 (0.4)	

Type of statistical test: Chi-square

Table 3. Comparative prevalence of oxygen saturation below and, above or equal to 90% for children treated under sedation

	Overall	Oxygen saturation < 90%	Oxygen saturation > 90%	p-value
n	1300			
BMI Classification				<0.001
Underweight (<5 <sup>th</sup> percentile BMI)	124 (9.5)	0 (0.0)	121 (9.5)	
Healthy weight (5 <sup>th</sup> to <85 <sup>th</sup> percentile)	941 (81.0)	3 (19.6)	834 (81.9)	
Overweight (85 <sup>th</sup> to <95 <sup>th</sup> percentile)	136 (9.5)	2 (16.5)	133 (9.9)	
Obese (>95 <sup>th</sup> percentile)	112 (8.1)	14 (23.7)	98 (7.3)	
No response	168 (12.9)	0 (0.0)	168 (12.6)	

Type of statistical test: Chi-square

Table 4. Prevalence of post-treatment excessive pain events between lidocaine and articaine local anesthesia for children treated under General Anesthesia

	Overall Anesthesia			p-value
	Overall	Lidocaine	Articaine	
n	1103	814	144	
Patient modified or complained of excessive pain; n (%)				<0.001
Yes	21 (1.9)	18 (2.2)	0 (0.0)	
No	1082 (98.2)	778 (95.8)	144 (100.0)	
No response	78 (8.9)	18 (2.2)	3 (2.1)	

Type of statistical test: Chi-square

## METHODS

This was a retrospective cohort chart review of patients being treated for Early childhood caries (**ECC**), under 7 years old, that received dental services under GA or OCS at Alaska, Florida, and Tennessee NYU Pediatric Dental Residency sites between January 10<sup>th</sup>, 2010, to December 31<sup>st</sup>, 2020. Research methods were designed to compare prevalence of adverse events in a randomly selected pool of subjects. Chi-squared test was used to compare prevalence of these adverse events to local anesthesia and obesity in a simple random sampling of subjects.

Subjects were identified by simple random searching electronic dental records for CDT code D9248 (oral conscious sedation) and CDT code D9420 (providing treatment in hospital or ambulatory surgical center) and obtaining an MRN. The MRN was used to access the patient’s chart in electronic health records to be evaluated for inclusion criteria on the corresponding date of service. Once subjects who meet the inclusion criteria have been identified, intraoperative chart notes were manually searched for the desired data.

## RESULTS

- The sample population had a median age of four to less than five and was mostly male (52.2%), Hispanic (35.4%), ASA 1 classification (83.2%), and Medicaid insurance (89.1%) (Table 1).
- There was one incident of hypotension in a patient treated without LA under GA, and none in patients treated with LA (p=0.165) (Table 2)
- Of the 19 (1.37%) who experienced O<sub>2</sub>S <90%, 73.7% had a BMI in obesity range, 15.8% and 10.5% were in healthy and overweight ranges respectively (p<0.001). (Table 3)
- No patients given Articaine under GA experienced post-treatment excessive pain (0%), compared to 2.2% of patients who received lidocaine (p<0.001) (Table 4)
- No mortality or significant morbidity was observed among the 2484 OCS and GA patient charts reviewed.

## CONCLUSIONS

Based upon this study’s results, the following conclusions can be made:

- There is no significant relationship between hypotension and use of LA during GA.
- Obese children are at a higher risk of O<sub>2</sub>S <90% during OCS.
- Patients receiving Articaine experience less post-treatment excessive pain than those receiving lidocaine during GA.
- Full mouth rehabilitation under GA to treat ECC with or without L2WE is safe in the NYU Pediatric Dentistry Residency setting is safe.

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