Local Anesthesia Preferences and Use by U.S. Pediatric Dentists

Maya Abdin, DMD; Nuntiya Kakanantadilok, DMD
Albert Einstein College of Medicine/Montefiore Medical Center, Bronx, New York

Introduction

Administering local anesthesia (LA) to children in pediatric dentistry has been necessary in the treatment of caries since it first was used in dentistry in 1884. The instruments and techniques for treatment of caries, especially when approaching the nerve/pulp, are pain-inducing. Use of LA alleviates that pain. However, the administration of said anesthesia poses its own set of difficulties when working with children, as the insertion of the needle into mucosa is not pain-free. Several advances in LA techniques include Oraverse™ injection (phentolamine mesylate), the Wand (STA Single Tooth Anesthesia® System), and the use of buffered anesthethetic solutions. All of these advancements share a common goal of reducing pain during and after administration of LA.

A common complication of LA use in children is residual post-operative numbness, which can last up to 3 to 5 hours after dental procedures have been completed. Patients may find that their ability to speak, smile, eat and drink are impaired, and may even have uncontrollable drooling (7). Soft tissue trauma to the lips following LA administration occurs due to the patient's unfamiliarity with the sensation of being numb. OraVerse™ was the first reversal agent on the market indicated to counteract residual post-operative numbness. It is injected into the same LA injection site after the procedure is complete to reverse the effects of LA.

Another side effect of LA is pain at the injection site during administration. This potentially creates fear and anxiety in many patients, especially in the pediatric population. Colares et al., in a cross-sectional study on 970 children between 5 and 12 years old, found the prevalence of dental fear and anxiety to be 14.4%. The strongest fears were associated with injections, which lead to avoidance of the dental setting untreated caries (3). To address this need, a computerized local anesthetic delivery system, the Wand STA® system was developed to reduce pain during injections by regulating the flow rate of LA and relieving pressure at the site.

LA injections can also be painful is due to the acidic nature of the solution. Most commercially available LA solutions used in dentistry have a pH of 3.5 to 5.0. This is largely because manufacturers constitute the solutions as hydrochloride salts to improve solubility and stability, which consequently prolongs shelf life. Furthermore, LA solution with vasoconstrictor is even greater in acidity. Injecting acidic LA solutions disrupt local tissue pH for a prolonged period, resulting in a burning sensation and pain (8). Buffering LA has been a practice used by dentists for decades. In a systematic review, studies comparing buffered vs. nonbuffered LA in children aged 5 to 12 years and receiving inferior alveolar nerve block (IANB) found a significantly lower duration of anesthesia onset with buffered LA solutions (P = 0.00001) (8). Another systematic review found that LA buffered with sodium bicarbonate was 2.3 times more likely to achieve successful anesthesia than nonbuffered LA for participants with a clinical diagnosis of symptomatic irreversible pulpitis requiring endodontic treatment (5). In the pediatric dental population, reducing onset time of LA with a buffering agent would be a great advantage since the working time for children can be limited due to behavior and short attention span.

Objectives/Hypothesis

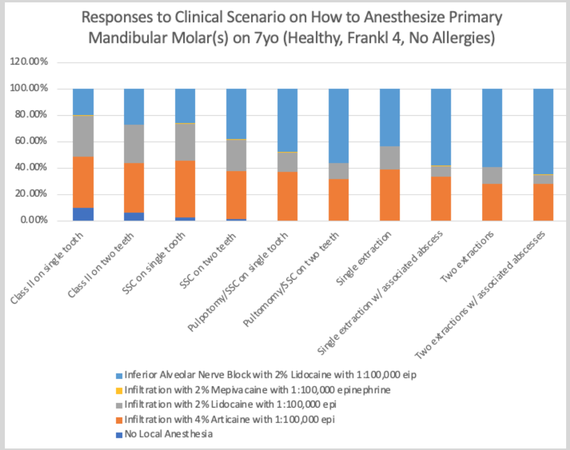
The purpose of the study was to gather data from pediatric dentists and pediatric dental residents regarding their preferred local anesthesia techniques, familiarity with reversal and/or buffering agents, as well as alternative delivery tools. An electronic survey asked responders to choose specific techniques based on several clinical scenarios. Descriptive statistics were used to report the results.

While this is a descriptive study, the researcher expect that dentists who have been practicing fewer years will be more likely to be familiar with and utilize the OraVerse™ reversal agent and the Wand alternative delivery system.

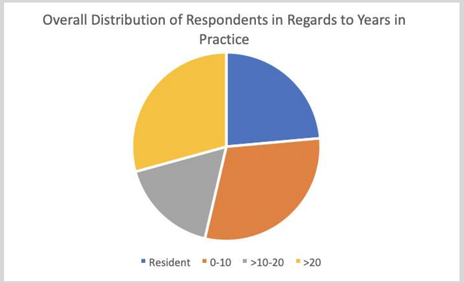
Study Design & Methods

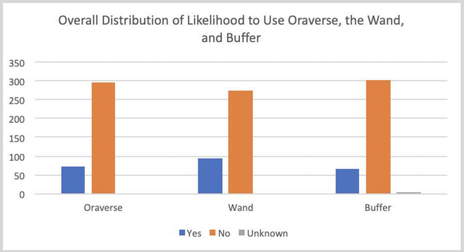
The study was designed as an electronic survey which included 18 multiple choice and clinical scenario questions. The survey was distributed by email using the American Academy of Pediatric Dentistry (AAPD) membership list and answers were collected via the SurveyMonkey electronic platform (www.surveymonkey.com). The researchers hoped to gain valuable information regarding local anesthesia use among pediatric dentistry which will benefit and inform our professional community.

Results



Results Continued





Statistical Analysis

	Years in Practice				
Outcome	Resident N = 87 (24%)[1]	0-10 N = 111 (30%)	>10-20 N = 63 (17%)	>20 N = 108 (29%)	p-value[2]
OraVerse					0.010
Yes	7 (8.0%)	21 (19%)	14 (22%)	29 (27%)	
No	80 (92%)	90 (81%)	49 (78%)	79 (73%)	
Wand					0.022
Yes	13 (15%)	28 (25%)	15 (24%)	37 (34%)	
No	74 (85%)	83 (75%)	48 (76%)	71 (66%)	
Buffer					0.14
Yes	10 (11%)	18 (17%)	11 (17%)	26 (24%)	
No	77 (89%)	91 (83%)	52 (83%)	82 (76%)	

[1]n (%)

[2]Pearson's Chi-squared test

The table above summarizes the associations between years of practice and select treatment options. Statistical analysis was completed using a Pearson's Chi-squared test and percentages reported to a 95% CI.

Discussion

There was a statistically significant association between years of practice and use of OraVerse™ reversal agent (p=0.01). A higher tendency to use OraVerse™ with longer years of practice was observed. Similarly, there was a statistically significant association between years of practice and use of the Wand STA® System (p=0.022). A higher tendency to use the Wand with longer years of practice was also observed. There was no evidence of any significant statistical association between years of practice and use of a buffering agent (p=0.14). However, there was a trend of higher tendency to use of a buffering agent with longer years of practice.

While the researchers initially hypothesized that pediatric dentists who have been practicing fewer years would be more likely to use a local anesthesia reversal agent or alternative delivery systems, the results of the study revealed the opposite to be true. It is possible that more experienced pediatric dentists have the opportunity and motivation to explore novel methods in order to create a more enjoyable encounter for their patients. Having optimized their personal techniques for local anesthesia administration, they are free to focus on alternative choices. More experienced dentists may also have had greater exposure to post-anesthesia complications such as self-inflicted injuries of the lips/cheeks/tongue, and therefore appreciate the importance of mitigating it when possible.

Common barriers preventing the use of OraVerse™ among all pediatric dentists were cost, need for re-injection, and product availability at their offices. Barriers associated with the use of the Wand STA® system were cost, availability, and the fact that many pediatric dentists were already confident in their ability to deliver local anesthesia painlessly.

Limitations of the study included a small sample size, risk for bias, and a low respondent rate among AAPD membership. Therefore, study results may not be generalizable to all Pediatric Dentists in the U.S.

Conclusion

Longer years of practice by the pediatric dental provider was positively associated with a higher tendency to use both Oraverse™ reversal agent and the Wand STA® system.

References

1. American Academy of Pediatric Dentistry. Use of local anesthesia for pediatric dental patients. The Reference Manual of Pediatric systematic reviewDentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2021:332-7.
2. Chi D, Kanellis M, Himadi E, Asselin ME. Lip biting in a pediatric dental patient after dental local anesthesia: a case report. J Pediatr Nurs. 2008 Dec;23(6):490-3. doi: 10.1016/j.pedn.2008.02.035. Epub 2008 Sep 10. PMID: 19026918; PMCID: PMC2745219.
3. J Dent Anesth Pain Med. 2020 Oct;20(5):271-279. doi: 10.17245/jdapm.2020.20.5.271. Epub 2020 Oct 30. PMID: 33195805; PMCID: PMC7644362. Garret-Bernardin A, Cantile T, D'Antò V, Galanakis A, Fauxpoint G, Ferrazzano GF, De Rosa S, Vallogini G, Romeo U, Galeotti A. Pain Experience and Behavior Management in Pediatric Dentistry: A Comparison between Traditional Local Anesthesia and the Wand Computerized Delivery System. Pain Res Manag. 2017;2017:7941238. doi: 10.1155/2017/7941238. Epub 2017 Feb 15. PMID: 28293129; PMCID: PMC5331308.
4. Jones JE, Dean JA. Local anesthesia and pain control for the child and adolescent. In: Dean JA, ed. McDonald and Avery's Dentistry for the Child and Adolescent. 10th ed. St Louis, Mo.: Mosby; 2016:274-85
5. Kattan S, Lee S-M, Hersh EV, Karabucak B. Do buffered local anesthetics provide more successful anesthesia than non-buffered solutions in patients with pulpally involved teeth requiring dental therapy?: A systematic review. J Am Dent Assoc 2019;150(3):165-177
6. Malamed SF, Gagnon S, Leblanc D. A comparison between articaine HCl and lidocaine HCl in pediatric dental patients. Pediatr Dent. 2000 Jul-Aug;22(4):307-11. PMID: 10969438.
7. Prasanna JS. OraVerse: Reverses Numbness After Dental Procedures. J Maxillofac Oral Surg. 2012 Jun;11(2):212-9. doi: 10.1007/s12663-011-0318-6. Epub 2012 Feb 5. PMID: 23730072; PMCID: PMC3386412.
8. Tirupathi SP, Rajasekhar S. Buffered versus unbuffered local anesthesia for inferior alveolar nerve block injections in children: a systematic review