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# Knowledge, attitude, and practices amongst pediatric dentists in Pune towards Local Anaesthetic allergy and test dose in dental operator: A questionnaire study

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## ABSTRACT

**Aim:** The aim of the survey is evaluate the current knowledge, attitude and practices of paediatric dentist towards local anaesthesia allergy and test dose administration in the dental operator. **Material and Methods:** A 25-question questionnaire was framed in accordance with local anesthesia guidelines amongst 103 pediatric dentists residing in Pune. Data collection was done by sending the questionnaire to the participants through google forms via e-mails/WhatsApp. The responses to questionnaires were summarized and this was accomplished by converting the online recorded information into representative numbers (codes). The data was entered into the Statistical Package for Social Sciences (SPSS) and analyzed. **Results:** Most of them, about 62.83% were not well aware of protocols for LA allergy testing. Maximum of participants, 30% did not know if the dose of epinephrine (1:1000) can be given in a child less than 30 kgs. Epinephrine was the drug chosen by 88% to be their first choice in management of anaphylaxis. 70% preferred Intramuscular as initial route for epinephrine injection. 60% said they have never seen a patient with local adverse reaction after use of local anesthesia. **Conclusion:** The lack of information among dental practitioners about maximum doses and dose estimates for local anesthetics for children was alarming; mainly as LA systemic toxicity was dose dependent. Our study suggested conducting additional educational courses to keep both general dental practitioners and specialists up-to-date on proper application of these vital components of dentistry.

**Keywords:** Pediatric dentists, knowledge, practice, local anesthetic, allergy, test dose

## 1. INTRODUCTION

The child patient's most prevalent fear in the dental office is the fear of pain, one which nature has endowed the child as a means of self-protection. Unfortunately, most children are conditioned to expect pain as a certain part of dentistry's routine – even before they experience any dental service themselves (Litt, 1996). Local anesthetics (LA) are a reliable, effective, low-cost, and widely available anesthetic. These medications are grouped as esters or amides, and their effect might be short, intermediate, or long. Other constituents, like vasoconstrictors, are equally important in LA delivery and the local anesthetic agent in the cartridge (Wahl and Brown, 2010). Many factors influence the required dose of LA, which involved age and weight, and medically impaired children must be considered when estimating the maximum dose of LA or a vasoconstrictor (VC).

Patients who experience systemic reactions after receiving LA are frequently referred to as 'allergic' to the local anesthetic. Drug overdose, vasovagal reactions, fast absorption, cardiovascular, intravascular injection, psychogenic or idiosyncratic reactions and central nervous system, were the most prominent causes for systemic sequelae (Sambrook et al., 2011). Although it is frequently claimed by patients, a true allergic reaction to dental LA is uncommon, including publications claiming allergic reactions to LA accounted for 1% of all adverse systemic reactions only (Sambrook et al., 2011; Haas, 2002).

A detailed understanding of these reactions, on the other hand, is beneficial because it gives the patient the highest chance of recovery and future usage of LA for pain management. Metabisulphite, the preservative added to several formulations, is the most likely allergen among the components included in LA cartridge (Sambrook et al., 2011). It is added as an antioxidant in products containing adrenaline, a VC (Haas, 2002). A case report of a verified allergy to ethylenediaminetetraacetic acid (EDTA) from LA was recently published in the literature (Russo et al., 2014).

Typically, skin prick and intradermal tests of suspected allergen triggers are used to identify allergies. On the basis of such skin tests, LA-induced allergic responses have been evaluated earlier (Seymour et al., 1999; Bhole et al., 2012). LA are regarded as relatively safe, but the high frequency of injections provided makes unpleasant reactions unavoidable (Haas, 2002). There has been a notable increase in the availability of local anesthesia (LA) products, including over-the-counter medications, in recent times. Consequently, it is possible that there has been a corresponding rise in the number of individuals who have developed sensitivity or an allergic response to LA.

In other countries, evaluations of dentists' knowledge and attitudes on LA-induced anaphylaxis have been conducted (Thyssen et al., 2008; Hepner and Castells, 2003; Lieberman et al., 2006). These investigations showed that dentists lacked sufficient skill in the identification and treatment of such responses. In India, the Pune region has not yet been the subject of such research. Thus, the present study aimed to assess the level of knowledge, attitude, and practice among pediatric dentists in Pune towards local anesthesia allergy and test dose in the dental operatory.

## 2. MATERIALS AND METHODS

A cross-sectional closed survey was performed amongst 103 Pediatric dentists who were practicing in the city of Pune, Maharashtra, India over a period of 6 months, from August 2022 to January 2023 which was conducted after acquiring the scientific and ethical clearance from the institutional review, scientific and ethical committee from Dr DY Patil Dental College & Hospital, Pune (DYPDCH/IEC/164/151/20). Since this was an e-survey, it was not possible to collect separate informed consents. Therefore, a brief outline of the purpose of study along with the inclusion criteria was explained and that their participation was voluntary keeping their details confidential. Hence, the response received from the Pediatric dentists was considered as an implied consent. The details of their demographics, knowledge, attitude and practice were collected through a pre-designed questionnaire by the principal investigator through an e-survey using Google forms (Table 1).

A 25-question questionnaire was framed in accordance with local anesthesia guidelines. Questions were later cross categorized based on knowledge, attitude and practice. Relatively easy questions were placed at the beginning of the questionnaire with difficult questions placed at the end. Data collection was done by sending the questionnaire to the participants through google forms via e-mails/WhatsApp. Before starting the study, the examiner pilot tested the online format of the questionnaire amongst 10 participants.

We wanted to be able to have confidence in the findings of the study, so we made sure that the questionnaire, when it was correctly filled out and administered, measured what it claimed it would measure consistently. In a nutshell, the questionnaire met both the criteria for validity and reliability. For face validity, the questionnaire had a professional appearance so that there was better chance of eliciting serious responses. In order to ensure that the questionnaire contained content validity, it was given to 10

Subject Matter Experts. They marked the questions as essential or non-essential based on the relevance, clarity, brevity of the questions. The data was collected and analyzed for Content validity ratio (CVR).

The reliability of the questionnaire, also known as its reproducibility, determines whether or not it operates consistently. The "test-retest method of reliability" was utilized, which refers to the ability of the questionnaire to produce comparable findings when it is given to the same individual on two distinct times. The correlation between the results is positively correlated with the reliability of the questionnaire. Ten participants took part in the test - retest reliability. Reliability of the questionnaire was checked using SPSS software. Kappa value was found to be 0.9 which indicated the questionnaire to be highly reliable. The online recorded data was transformed into representative numbers (codes), which allowed for the summary of the questionnaire replies.

The coding system was considered when the questionnaire was being developed. SPSS Version 26 software package (SPSS inc., IBM, and Chicago, IL, USA) was used to analyze the data. Numbers and Percentages were calculated for each item. Chi-squared test was applied to compare knowledge, attitude and practice based on the demographic variables (Number of years of experience in Pediatric dentists).

### 3. RESULTS

The present study was undertaken to assess the knowledge, attitude and practice of 103 Pediatric dentists residing in Pune city, with respect to local anesthesia hypersensitivity and test dose in dental operatory.

**Table 1** Participants' demographic information

Duration of practice		
Less than 5 years	19	18.4%
5-10 years	75	72.9%
More than 10 years	9	8.7%

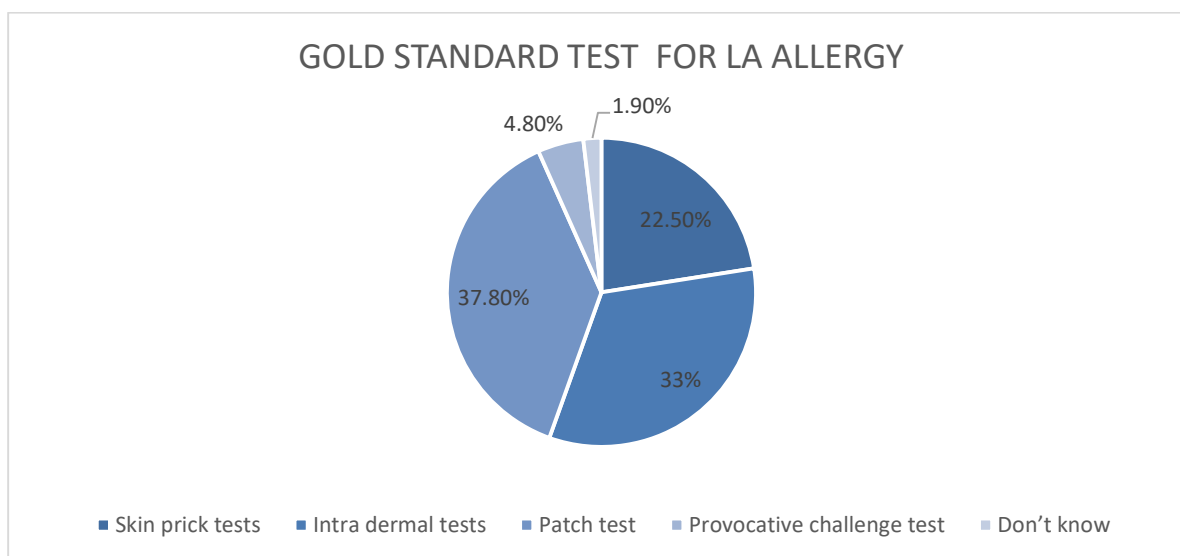
72.9% of the participants had practiced for 5 to 10 years, about 18.4% participants had practiced for less than 5 years and only 8.7% had experience of more than 10 years.

**Table 2** Knowledge regarding Local Anaesthetic (LA) allergy and test dose in dental operatory

Questions	Frequency N=103	Percent (%)
1. What types of adverse reactions are commonly associated with local anaesthesia administration?		
Systemic toxicity	12	11.6%
Local toxicity	12	11.6%
Psychogenic reactions	12	11.6%
Paraesthesia	12	11.6%
Soft tissue injury	13	12.9%
Allergic reactions	13	12.9%
All of the above	17	16.2%
Don't Know	12	11.6%
2. What components of local anaesthesia solution may cause hypersensitivity?		
Local anaesthesia	21	21.3%
Preservatives	60	58.2%
Anti-oxidants	3	2.2%
Adrenaline	4	3.8%
Don't know	15	14.5%
3. Hypersensitivity reactions are more common in		
Ester group LA	60	58.2%
Amide group LA	30	29.1%
None of the above	0	0

Don't know	13	12.7%
4. Are you well aware of protocols for LA allergy testing?		
Yes	60	58.2%
No	43	41.8%
5. Types of hypersensitivity reactions that may occur with LA		
Type 1 or Anaphylactic reactions	70	67.9%
Type 2 or Cytotoxic reactions	4	4%
Type 3 or Immune complex reactions	4	4%
Type 4 or T cell-mediated reactions	12	12%
All of the above	11	11%
Don't know	2	1.1%
6. Allergic reaction to LA can be seen within		
<2 hours	61	59%
<6 hours	2	2 %
6-24 hours	17	16%
Over 24 hours	3	3%
Any of the above	20	20%
7. What dose of epinephrine (1:1000) can be given in a child less than 30 kgs?		
0.10 mg/day	21	20 %
0.15 mg /day	23	22%
0.20 mg/day	20	20%
0.30 mg/day	8	8%
Don't know	31	30%

Most of the participants, 66.95% selected soft tissue injury as adverse reactions are commonly associated with local anesthesia administration. About 58.2% of them were unaware of the procedures for LA allergy testing. 67.9% described Type 1 or Anaphylactic reactions to be the hypersensitivity reactions that may occur with LA and 59% said allergic reaction to LA can be seen within <2 hours. Maximum of participants, 30% did not know if the dose of epinephrine (1:1000) can be given in a child less than 30 kgs.



**Figure 1** Knowledge regarding Gold standard for testing LA allergy

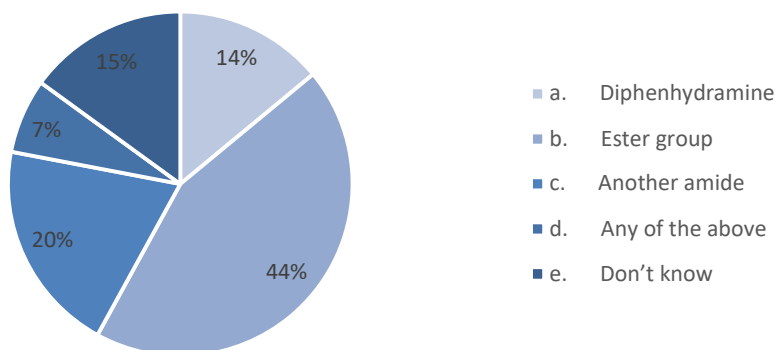
Figure 1 show only 4.8% of participants consider Provocative Challenge Test (PCTs) as the gold standard for testing LA allergy while 37.80%, 33% and 22.50% think patch test, intradermal tests and skin prick test as the standard test respectively.

**Table 3** Attitude regarding Local Anaesthetic (LA) allergy and test dose in dental operator

Questions	Frequency N=103	Percent (%)
1. When a patient reports a suspected allergy to local anesthesia, what is your approach?		
I do not begin the treatment	7	7%
I make a skin prick test with the suspected drug by myself	20	19%
I refer the patient to an allergy specialist with the suspected drug for testing	71	69%
I treat the patient without local anaesthesia	5	5%
2. Which route, do you prefer giving the test dose in?		
Intra oral	7	7%
Intra dermal	96	93%
Others	0	0%
3. Would you do an allergy test for patients without a prior suggestive history?		
Yes	26	25%
Not at all	34	33%
Sometimes if necessary	43	42%
4. What response, following the test dosage, do you think would be indicative of anaphylaxis?		
Skin rashes	31	30%
Itching	3	3%
Dyspnoea	4	3.5%
Sudden fainting	4	3.5%
All of the above	61	60%
Not sure	0	0%
5. What medication would you use first to treat anaphylaxis?		
Epinephrine	91	88%
Antihistamine	7	7%
Corticosteroids	1	0.9%
Glucagon	0	0%
Salbutamol	1	1.1%
Oxygen	3	3%
Don't know	0	0%
6. Which approach do you favour for epinephrine injection as a first course of action?		
Intramuscular	72	70%
Subcutaneous	21	20%
Intravenous	4	4.5%
I'm not sure	6	5.5%
7. Do you think it is important to keep oxygen and respiratory masks in the operator for emergency management?		
Yes	103	100%
No	0	0%

The attitude of operators about LA allergy and test dose is in (Table 3). 93% of participants, or almost all, preferred administering the test dosage intradermally. 88% of people selected epinephrine as their preferred medication option for treating anaphylaxis. 70% prefer intramuscular injections of epinephrine as the first approach. Every participant, that is 100%, though it is important to keep oxygen and respiratory masks in the operator for emergency management.

### Alternative anaesthetic the practitioner choose when patient is allergic to Lignocaine



**Figure 2** Attitude of operators about choice of an alternative for lignocaine

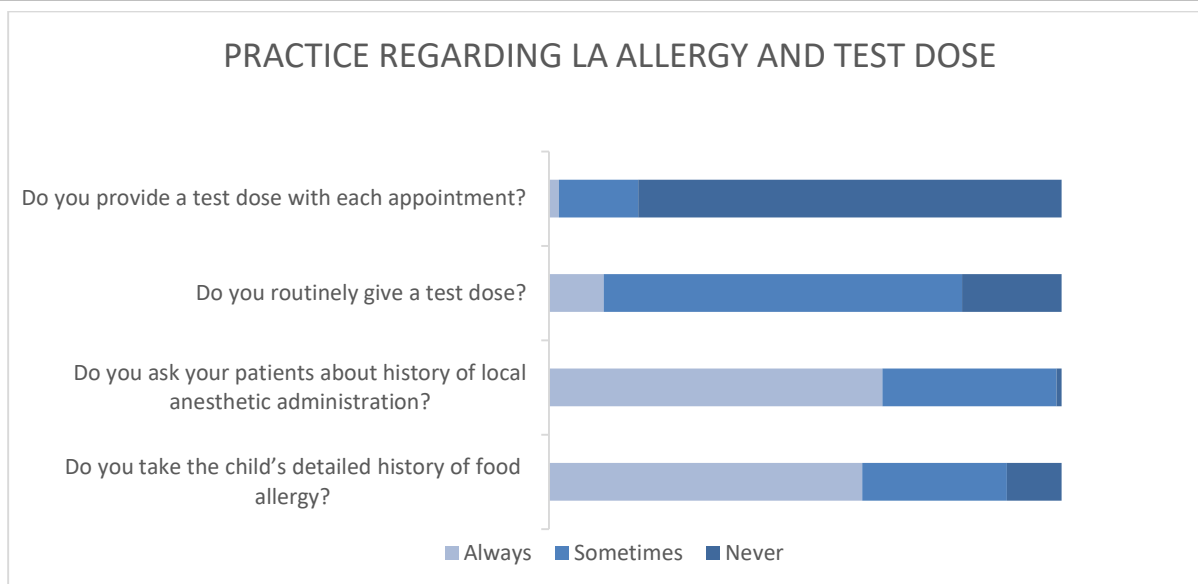
Figure 2 shows the knowledge of operators about an alternative for lignocaine. 44% participants would opt for an ester group LA if patient is allergic to Lignocaine.

**Table 4** Practice regarding Local Anaesthetic (LA) allergy and test dose in dental operator

Questions	Frequency N=103	Percent (%)
1. Have you encountered a patient who experienced a local adverse response following local anaesthesia?		
Yes	41	40%
No	62	60%
2. Have you encountered a patient who experienced a systemic adverse response following local anaesthesia?		
Yes	11	10.5%
No	92	89.5%
3. Do you maintain the following drugs at your office?		
Epinephrine	67	65%
Antihistamine	23	22%
Corticosteroids	6	6%
Glucagon	2	2%
Salbutamol	4	4%
None of the above	1	1%

Table 4 shows the response from dental operator regarding LA allergy and test dose. In the survey, 60% of respondents said they had never seen a patient have a local adverse reaction and 89.5% of respondents said they had never seen a patient have any systemic response after receiving local anesthesia.

Figure 3 shows the responses from operators about seeking history of LA administration. 83% do not give a test dose with each appointment while sometimes they administer a test dose. However, most of them take previous history of LA administration and any associated food allergy.



**Figure 3** Practice regarding LA allergy and test dose in the operatory

#### 4. DISCUSSION

True allergy to LA, particularly amide local anesthetics, is extremely rare (Sambrook et al., 2011). Rood, (2000) performed cutaneous and intraoral challenges on 44 adult patients who were thought to have a LA allergy and came to the conclusion that most of the symptoms were psychogenic in nature and that no allergy was ever observed to be present. Only one of these patients over this time had a documented allergy to mepivacaine, demonstrating a rather infrequent reaction to dental local anesthetics (Gall et al., 1996).

In developed nations, anaphylactic responses to LA following dental procedures have been observed, with a frequency of 1 in 3,500 to 1 in 13,000 instances (Vervloet et al., 1999; Laxenaire, 1999). Australia and Norway have recorded incidences of 1 in 10,000 to 1 in 20,000 and 1 in 6,000, respectively, in recent studies (Hepner and Castells, 2003; Lieberman et al., 2006; Webb and Lieberman, 2006). Therefore, the purpose of the current study was to evaluate the degree of knowledge, attitude, and practice among pediatric dentists in Pune about local anesthesia allergy and test dosage in dental operatory. A total of 103 members participated in the present study. Pediatric dentist residing in Pune city were approached for the study.

According to studies, the majority of practicing dentists utilize low dosages of local anesthetic and vasoconstrictor (Carolina et al., 2015). Anaphylactic drug allergy is one of the most unpredictable ADRs because it is unrelated to dosage and can be lethal. Hypersensitivity to local anesthetic solution can sometimes be misinterpreted by practitioners as toxicity to LA agent and/or the VC, as well as anxiety symptoms (Canfield and Gage, 1987). The British Society for Allergy and Clinical Immunology's Standards of Care Committee explained how to investigate suspected anaphylaxis during general anesthesia. It is noted that skin prick tests and intradermal testing have not been validated due to the rarity of a true LA allergy. As a result, it is recommended to proceed to progressive subcutaneous challenge as needed/appropriate only after such testing (Ewan et al., 2010).

Approximately 5-10% of all adverse drug reactions (ADRs) are classified as drug allergies, which fall under the category of unpredictable ADRs. Drug allergies comprise a wide range of immunologically induced hypersensitivity reactions with diverse mechanisms and clinical manifestations (Dewachter et al., 2009; Sicherer and Leung, 2013). Allergies to preservatives in local anesthetic solutions are substantially more common (though still uncommon). Preservatives, such as bisulfite, which is included in multidose vials, are another unusual source of an immediate-type reaction to LA (Pavlidakey et al., 2009).

Atopic illnesses, like hay fever, allergic rhinitis, and asthma, were not risk factors for LA sensitivity, but dentists frequently direct patients with atopic diseases to allergy clinics for drug allergy testing. Our study reported that 58.2% practitioners believed preservatives to be the cause (Table 2 Q2). Anaphylaxis is one of the most critical clinical settings seen in everyday medicine. In over 70% of patients, symptoms ranging from the skin to the CVS and respiratory systems are present at the same time. Anaphylaxis must be identified and treated as soon as possible (Lieberman, 2006) because anaphylaxis may be encountered in their ordinary practice, albeit it is not common (Sampson et al., 2006). Our study reported 67.9% practitioners were aware about this type I allergy (Table 2 Q5).



The most successful method of managing drug allergies is the avoidance of the offending substance or discontinuing its use. Whenever feasible, alternative pharmaceuticals with entirely different chemical structures should be chosen as substitutes for the original medication. When selecting alternative agents, it is crucial to consider the potential for cross-reactivity between different medications. Similar to another study, our findings showed that most of the dentists are aware of this fact and 58.2% believed that Ester group was most commonly associated with Hypersensitivity reactions (Cetinkaya et al., 2011) (Table 2 Q3).

The ester group of anesthetics carries a higher risk of unfavorable allergic responses than the amide group does. The preservatives methyl paraben and metabisulfite were most likely the cause of some of the adverse responses that persons described. Caine, the anesthetic agent, did not cause allergic reactions in all of the people who reported allergic reactions. Epinephrine, antihistamines, and corticosteroids are all relatively inexpensive medications, and as a result, they should be stocked at every medical facility (Anchor and Settupane, 2004).

Our study findings were in agreement with other research showing about 65% of the dentists kept epinephrine ready in their offices and 88% administered it in ADRs (Table 4 Q3). When faced with an anaphylactic episode, the recommended course of treatment involves administering an intramuscular injection of epinephrine into the lateral thigh (Simons and Simons, 2010). The indicated approach of administering epinephrine via the IM method was similar to that of the previous studies, with around 70% of dentists preferring the IM route for epinephrine administration (Table 3 Q6).

The dose of epinephrine prescribed is determined by the patient's weight. For children and adults weighing 30 kg or more, the average dose is 0.3 mg (Lee and Vadas, 2011). A maximum of practitioners of our study, 30% were not aware of the dosage while many were divided on their opinion. The other options like antihistamines and corticosteroids are also reported but in minute numbers by the practitioners in our study. Corticosteroids and antihistamines given systemically are other therapy alternatives for severe systemic reactions; however, they should never be given before or in place of epinephrine when dealing with anaphylactic patients (Sheikh, 2013; Sheikh et al., 2007; Kaira and Dabral, 2014).

Many complications can arise from the incorrect administration of LA; thus, various protocols need to be followed when employing LA of which only 43.26% of the general dental practitioners were aware of while the remaining 62.83% of the respondents were unaware (Liau et al., 2008; Conrado et al., 2007; Rishiraj et al., 2005). It is particularly critical when anesthetics are delivered to medically impaired patients or children by an unaware practitioner, because the doses of local anesthetics and vasoconstrictors administered to these patients and children differ from those administered to healthy individuals (Conrado et al., 2007; American Academy on Pediatric Dentistry Council on Clinical Affairs, 2008; Lipp et al., 1993; Mochizuki et al., 1989).

Lastly, it is exceedingly rare to experience allergic reactions to local anesthesia; however, in the event they do occur, they can pose life-threatening risks. The lifetime prevalence of anaphylaxis is increasing, and it is noteworthy that the incidence of anaphylaxis in children is higher than in adults (Lee et al., 2020). Patients with anaphylaxis often lack awareness of the seriousness of their condition when visiting their dentists. Therefore, it is essential for dental professionals to be well-versed in the causes and management of anaphylaxis. Furthermore, nationwide continuing dental education (CDE) programs focused on anaphylaxis, such as conferences, workshops, journal clubs, and seminars, could prove beneficial in extensively educating dentists on this matter.

## 5. CONCLUSION

Anaphylaxis occurring during dental procedures is infrequent; however, when it does happen, the consequences can be severe. The concerning lack of understanding among dental professionals regarding optimal dosage limits and estimations for local anesthetics in children, as observed in our study, should be corroborated to the fact that systemic toxicity from local anesthetics is dependent on the dosage administered. This suggests the need for additional educational programs aimed at keeping dentists, both general practitioners and specialists, updated on the correct utilization of these crucial elements in dentistry.

The study's findings highlight the dentists' limited experience in managing such reactions. To tackle this issue, it is crucial to enhance dentists' proficiency in basic life support. Attending continuing dental education courses in this field, encompassing workshops and practical training, should be deemed necessary.

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We thank the participants who were all contributed samples to the study.

### Author Contributions

Details of contribution of each authors regards manuscript work & production.



### Ethical approval

The study was approved by the Medical Ethics Committee of Dr DY Patil Dental College & Hospital, Pune (Ethical approval code: DYPDCH/IEC/164/151/20).

### Informed consent

Informed consent was obtained from all individual participants as implied consents who chose to participate in the study.

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This study has not received any external funding.

### Conflict of interest

The authors declare that there is no conflict of interests.

### Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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