Journal of Scientific Innovations in
Anesthesiology

REVO PUBLICATION

Original Research Article

Challenges in achieving adequate local anesthesia in dental procedures: A KAP assessment of practitioners' techniques

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Abstract

Background: In dental practice, local anesthesia plays a very important role as it makes the patient more comfortable during his or her procedures. Nevertheless, difficulty in getting adequate anesthesia is still common because of several reasons such as the differences in anatomy, psychological considerations as well as technique related problems. The research paper will identify the knowledge, attitudes and practices (KAP) of dental professionals in relation to local anesthetic use and subsequent improvement of pain management in dentistry by establishing areas of weaknesses and suggesting means to address them.

Methods: A cross-sectional survey of 150 dental practitioners comprising general dentists, dental surgeons as well as specialists was carried out to determine knowledge, attitudes and practices of dental practitioners with regard to local anesthesia. The questionnaire was made to gauge the knowledge of the respondents with regard to anesthetic agent, effects of psychological factors, and how the respondents approach the issue of anesthesia failure in their practice. Analysis was done based on descriptive statistics to give an insight into the common practices and areas of concern.

Results: The survey showed that 85 percent of respondents used Lidocaine as their choice of anesthetic, 60 percent of them reported anatomical differences as the major factor of anesthesia efficacy and 85 percent of the respondents reported the critical role of patient anxiety. On the issue of confidence in administering local anesthesia, 40 percent had high confidence and 50 percent had some incidences of poor anesthesia. In case of the failure in anesthesia, 60 percent of practitioners chose to administer higher dosage instead of sending patients to experts.

Conclusion: Although the majority of dental practitioners have a good grasp of the knowledge and confidence in the administration of the local anesthesia, there are some areas where improvements can be made, especially when addressing the psychological factors and communicating with patients. Patient-centered care methods and additional training are critical to maximising the efficacy of anesthesia.

Keywords: Local anesthesia, Dental practitioners, Knowledge, Patient anxiety, Anesthesia failure.

Received: 28-11-2025

Accepted: 10-01-2026

Published: 30-01-2026

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https://doi.org/10.65929/JSIA.2026.1.1.002

How to cite this article: Kashwani R, Kumari A, Sawhney H. Challenges in achieving adequate local anesthesia in dental procedures: A KAP assessment of practitioners' techniques. *J Sci Innov Anesthesiol*. 2026;1(1):10–18.

1. Introduction

Local anesthesia is an essential part of the modern dental practice as it gives the required method of pain management in the process of performing several dental operations. Regardless of whether it is a regular filling, root canal, or tooth removal, successful local anesthesia will make the patients feel relaxed and without pain thereby making the procedures smoother and satisfying the patients.[1] Nevertheless, proper local anesthesia in the practice of dentistry is still a challenge to many dentists despite the development of anesthetic agents and methods. Patient anatomy, psychological influences, and the nature of dental procedures may all influence the efficacy of local anesthesia, thus it is a complex issue that requires much attention as well as skillful practice.[2]

The anatomy of patients is one of the major variables that determine the effectiveness of local anesthesia. Each person possesses a series of anatomical differences that may affect the anesthetic agent distribution and efficacy,

including differences in nerve position, bone density, tissue structure, and others. Also, there are anatomical areas, which pose special difficulties, like the maxillary and the mandibular arches.[3] In the mandibular arch as an example, anesthesia can be a difficult task because of the thickness of the bone structure as well as the complexity of the nerve supply. These anatomical problems are compounded in the case of anatomical anomalies like in a patient who has mandibular tori or changes in the mental foramen.[4]

Local anesthesia also depends on patient factors. Even with the anesthetic technique well performed, psychological factors that may lead to the perception of pain include anxiety, fear and stress. It is possible that some patients will have a greater pain threshold or are more sensitive to anesthesia whereas others may be less sensitive to specific anesthetics as a result of genetic factors or drug interactions.[5] More so, age, medical history, comorbid conditions like diabetes or hypertension could have an impact on the pharmacodynamics and pharmacokinetics of local anesthetic drugs and the effect and duration thereof.[6]

The methods of practitioners are one more determinant of the sufficient local anesthesia. Although dental practitioners undergo a lot of training on administration of anesthesias, the variety of individual techniques used in clinical practice is usually vast. Change in the position of the needle to be used, the amount of anesthetic injected and the application of supplementary methods like additional injections or nerve blocks can all contribute to outcome of anesthesia.[7] In addition, experience and knowledge of a specific procedure and anatomical difficulties might influence the quality and effectiveness of anesthetic administration by a practitioner. Poor training or confidence may in certain cases result in poor anesthesia which causes discomfort to the patient and may require further intervention.[8]

Also, the dental procedure itself is complex and can greatly contribute to the failure of local anesthesia. Invasive surgeries like tooth removals, implant installations, or even surgeries may demand a deeper or more profound anesthesia and this may prove hard to accomplish in some patients. Moreover, long-term procedures may necessitate the repetition of anesthetics, which may make it difficult to control pain management and leave the possibility of complications.[9]

This study explored the problems that dental practitioners face in achieving sufficient local anesthesia. The study will survey dental professionals in order to understand the methods they use to overcome these challenges, the most frequent problems, as well as evaluate the effect of various factors on the success of anesthesia. This study will bring important insights on how the situation can be improved by comprehending the issues experienced by the practitioners which will eventually help in improving the methods used in managing pain in dental care. By gaining a better insight into the factors which determine the effectiveness of the local anesthesia, dental professionals will be able to enhance their practice, maximize the outcomes related to the patients, and, in the long run, increase the quality of dental care they provide.

2. Methodology

The paper will adopt a Knowledge, Attitudes, and Practices (KAP) framework to determine the methods employed by dental professionals in attaining sufficient local anesthesia when performing dental treatments. KAP model is popular in analyzing gaps in knowledge, assessing attitudes and studying the practice of the professionals within a medical setting. This model can be best applied in the context of local anesthesia in the dental field to learn not only what the dental professionals are aware of in the anesthetic techniques but also the attitude of the dental professionals towards anesthesia in their practice and outcome in the clinic.

2.1. Study Design

Data collection among dental practitioners was done in a cross-sectional survey design. The survey determined their knowledge of local anesthesia, their perception of the matter, and the strategies they use to successfully manage the pain during dental surgeries. The researchers will seek to determine the general challenges encountered by the practitioners and determine the impact of knowledge and attitudes on their practices.

2.2. Population and sampling

The target population will comprise practitioners in licensed dental practices, such as the general dentists, dental surgeons and specialists who work in different dental environments. The participants were selected using a purposive sampling method in dental clinics, a privacy practice, and various hospitals in various regions. Participants were eligible to take part in the study based on the following criteria:

1. Registered dentists who have one year of clinical practice.
2. Consent to take part in the research.
3. The ability to complete the survey.

2.3 Exclusion criteria were as follows:

1. Dental practitioners that are not engaged in the execution of procedures that involve local anesthesia.
2. Dentists with a clinical experience of less than one year.

2.4. Data collection

The primary data collection tool is a structured questionnaire designed specifically for this study. The questionnaire was distributed to participants through online platforms and in-person at various dental clinics and institutions. It consists of three sections corresponding to the KAP framework:

1. Knowledge: Questions about the principles, techniques, and pharmacology of local anesthesia.
2. Attitudes: Questions assessing dental practitioners' attitudes toward the use of local anesthesia, including factors such as perceived effectiveness, patient comfort, and risks.
3. Practices: Questions about the actual techniques used by practitioners during dental procedures, including their approach to administering anesthesia, handling complications, and managing patients' concerns.

2.5. Data analysis

The data collected from the survey was analyzed using both descriptive and inferential statistics. Descriptive statistics will summarize the demographic data, knowledge scores, attitudes, and practices of the participants. Inferential statistics, such as chi-square tests and t-tests, were employed to explore the relationships between the practitioners' knowledge, attitudes, and practices and their experiences with local anesthesia. A correlation analysis will also be conducted to assess any significant associations between attitudes toward local anesthesia and the success rates of anesthetic techniques.

2.6. KAP questionnaire design

The KAP questionnaire used in this study was designed with reference to existing literature on dental anesthesia and best practices. It includes multiple-choice, Likert scale, and open-ended questions to collect both quantitative and qualitative data. Below is a sample of the KAP questionnaire for the study:

Section	Question	Options
Knowledge of Local Anesthesia	1. Which of the following is the most commonly used anesthetic agent in dentistry?	a) Lidocaine b) Bupivacaine c) Mepivacaine d) Procaine
	2. Which of the following factors most influences the success of local anesthesia in dental procedures?	a) Needle size b) Drug dosage c) Anatomical variations d) Patient age
	3. What is the recommended duration of action for a typical local anesthetic used in dental procedures?	a) 1–2 hours b) 3–4 hours c) 6–8 hours d) 10–12 hours
	4. Local anesthetics primarily block which type of nerve fibers?	a) Motor fibers b) Sensory fibers c) Autonomic fibers d) Both motor and sensory fibers
	5. What is the maximum recommended dose of lidocaine for a healthy adult?	a) 2 mg/kg b) 4.5 mg/kg c) 5 mg/kg d) 7 mg/kg
Attitudes Towards Local Anesthesia	6. How confident are you in achieving adequate local anesthesia for all types of dental procedures?	1 (Not confident) 2 3 4 5 (Very confident)
	7. Do you believe that patients' anxiety or fear affects the success of local anesthesia?	a) Yes b) No c) Unsure
	8. How often do you discuss anesthesia options with patients before performing a procedure?	a) Always b) Often c) Sometimes d) Never
	9. In your opinion, how effective is local anesthesia in preventing pain during dental procedures?	a) Very effective b) Moderately effective c) Not very effective d) Ineffective
	10. Do you feel there is enough training on the latest anesthetic techniques in your professional development?	a) Yes b) No c) Unsure

Section	Question	Options
Practices in Administering Local Anesthesia	11. Which anesthetic technique do you primarily use for mandibular block anesthesia?	a) Inferior alveolar nerve block b) Gow-Gates block c) Vazirani-Akinosi technique d) Other (please specify)
	12. How often do you experience situations where local anesthesia is inadequate during a procedure?	a) Frequently b) Occasionally c) Rarely d) Never
	13. If local anesthesia fails, what is your next course of action?	a) Administer additional anesthetic b) Try a different injection site c) Refer the patient for specialist care d) Abort the procedure
	14. In cases of severe dental anxiety, do you prefer to use additional sedative methods alongside local anesthesia?	a) Yes b) No c) Sometimes
	15. How do you manage patients who report discomfort during the administration of local anesthesia?	a) Reassure them and proceed b) Adjust technique and proceed c) Pause the procedure and offer more anesthesia d) Stop the procedure and refer for further evaluation

2.7. Ethical considerations

The study adhered to ethical guidelines for research involving human participants. Informed consent was obtained from all participants, and their anonymity and confidentiality will be ensured. Participants were informed about the purpose of the study, their right to withdraw at any time, and the voluntary nature of their participation.

3. KAP (Knowledge, Attitudes, and Practices)

KAP (Knowledge, Attitudes, and Practices) survey on local anesthesia in dental procedures were examined to investigate the knowledge, attitudes, and practices of dental practitioners in respect to having adequate local anesthesia. The survey questionnaire reached 150 dental practitioners comprising of general dentists, dental surgeons and specialist in different individual clinics, hospitals, and dental schools.

3.1. Knowledge of local anesthesia

The survey showed that the dental practitioners and dentists generally had a good grasp of the fundamental concepts of local anesthesia. Lidocaine was the most widely used anesthetic agent in dentistry with 85% of the respondents identifying it, and Mepivacaine (10%) and Bupivacaine (5%). This implies that within the clinical practice, Lidocaine is the norm (**Figure 1**).

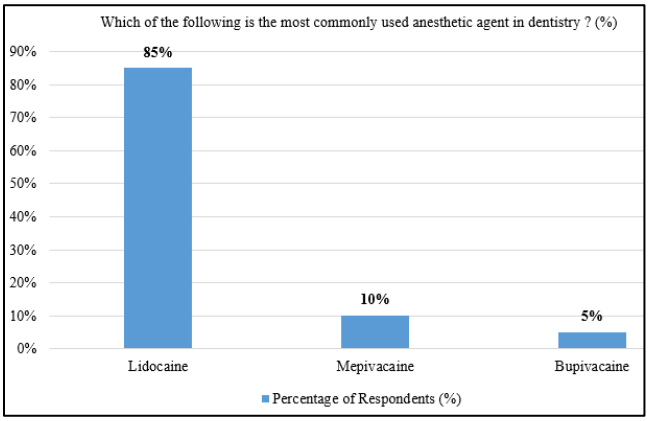

Figure 1: Which of the following is the most commonly used anesthetic agent in dentistry?

In responding to the question of what factors have the greatest impact on local anesthesia success, 60% of the practitioners stated that Anatomical variations are the most important factor, Drug dosage (25%), and Needle size (10%). This means that dental practitioners have a high knowledge regarding how patient anatomy influences the success of anesthesia (**Figure 2**).

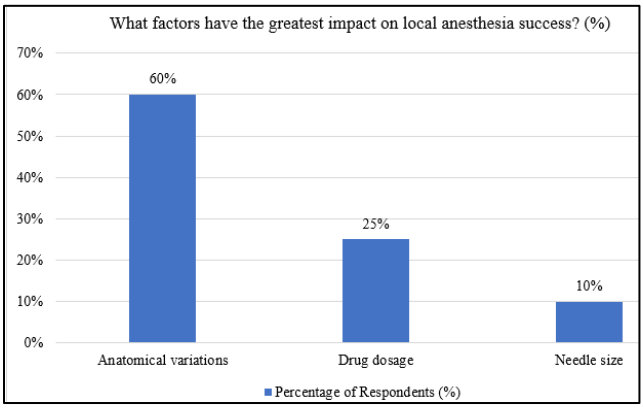

Figure 2: What factors have the greatest impact on local anesthesia success?

Regarding the time-period of action, 80 percent of the respondents ranked the common local anesthetics, such as Lidocaine, as 1-2 hours, which indicated the correct perception of the expected action duration of the most commonly used anesthetic drugs. In terms of the kind of nerve fibers that local anesthetics block, 90% of the participants gave the correct response in that Sensory fibers are the major target, this indicates a good understanding of the pharmacological actions of such drugs.

Table 1: Percentage of respondents who correctly identified the expected duration of action of common local anesthetics and the primary nerve fibers blocked by these drugs

Factor	Percentage of Respondents (%)
Duration of Action (1-2 hours)	80%
Correct Response on Nerve Fibers	90%

Safe dosing practices were also discussed and 70 percent of the practitioners were able to answer how much Lidocaine was maximum recommended dose of 4.5mg/kg which showed a good knowledge of dosage safety measures.

3.2. Attitude towards local anesthesia

Dental practitioner attitudes toward local anesthesia were mostly positive, although there are areas where they could use some improvements with 40% reporting to have full confidence in achieving adequate local anesthesia to all types of dental procedures, 35% reported moderate confidence, and 25% were less confident. This shows that although majority of the practitioners are sure to handle local anesthesia, there is still a group of practitioners who might have difficulties in this field.

Table 2: Dental practitioners' confidence levels in achieving adequate local anesthesia for all types of dental procedures

Confidence Level	Percentage of Respondents (%)
Full Confidence	40%
Moderate Confidence	35%
Less Confident	25%

Another important finding was that nervousness or fear in patients has a major impact on the effectiveness of local anesthesia, 85% of practitioners saw that the psychological factor of pain control is the key. More so, half of the respondents reported that they would always talk to patients about anesthesia choices prior to performing a procedure, which portrays that there is a great tendency to engage in patient education and communication. Nevertheless, a third of them said that they occasionally discuss anesthesia options, with 15 percent declaring that they never discuss them in detail, which is one place where more of a focus on patient engagement may be applied.

According to the effectiveness of the local anesthesia, 70 percent of the respondents ranked the local anesthesia as very effective in preventing pain during the dental procedure with 20 percent ranking local anesthesia as moderately effective and 10 percent ranked local anesthesia as either not very effective or ineffective. This indicates that although a majority of practitioners consider the local anesthesia as a form of pain management that works, a minor section of them might be worried about the trustworthiness of the method.

On the suitability of professional training, 55 percent of the respondents said that they have had enough training on the new methods of anesthesia, whereas 30 percent said that they have not received training on the new methods hence there is a need to continue the professional training on the same (**Table 3**).

Table 3: Suitability of professional training

Factor	Percentage of Respondents (%)
Impact of Nervousness/Fear on Effectiveness	85%
Always Discuss Anesthesia Choices with Patients	50%
Occasionally Discuss Anesthesia Choices with Patients	35%
Never Discuss Anesthesia Choices in Detail	15%

3.3. Administration of local anesthesia practices

Practically, the survey revealed that majority of dental practitioners used common anesthetic procedures even though there was a slight variation in the answers as to particular practices. Inferior alveolar nerve block was the most popular method of mandibular block anesthesia with 75 percent of respondents and Gow-Gates block (15 percent) and Vazirani-Akinosi technique (10 percent) (**Figure 3**).

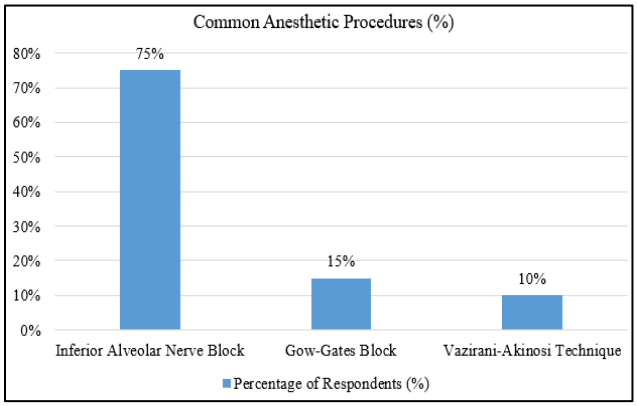

Figure 3: Common anesthetic procedures

Fifty percent of the practitioners indicated that they sometimes find themselves in some instances where they felt that local anesthesia was insufficient with 30% saying that they hardly ever experienced it and 20 percent saying that they constantly experienced it. It means that the local anesthesia failure is a widespread and yet not universal problem of dental practice, and a significant part of the practitioners face the suboptimal anesthesia in some situations (**Figure 4**).

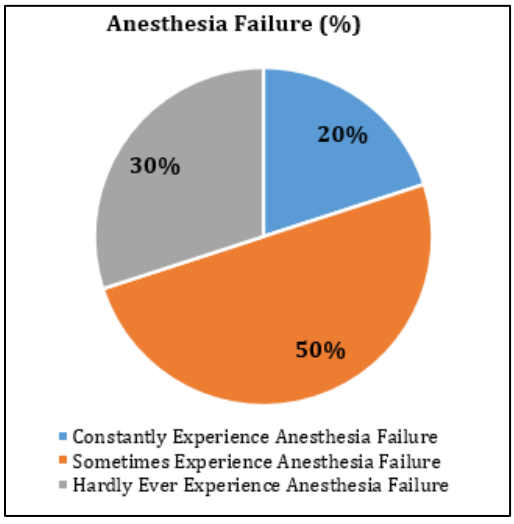

Figure 4: Anesthesia failure

When faced with a case of anesthesia failure, 60% of the practitioners would increase the dose of anesthetic, 20% would attempt a different site of injection and 10 percent would simply refer the patient to the specialist. Only a tenth of the respondents said that they would terminate the procedure, which demonstrates the willingness of the majority of practitioners to pursue remedial actions prior to ending a treatment (**Figure 5**).

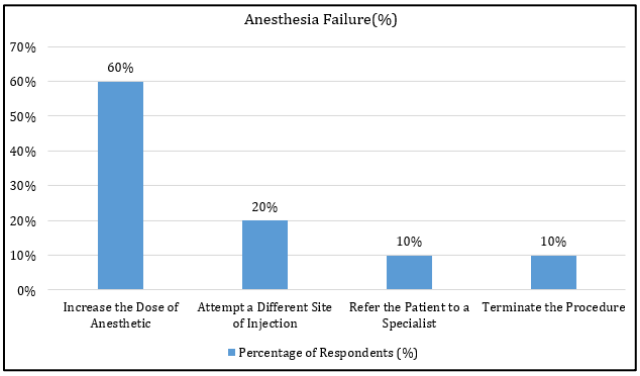

Figure 5: Anesthesia failure

On the issue of dental anxiety, 40 percent of the respondents said that they occasionally apply more forms of sedation to anxious patients in combination with local anesthesia, 30 percent responders used sedatives all the time, and another 30 percent of responders never used them. It is an indicator of a changing attitude towards treating anxiety in dentistry whereby some practitioners tend to use sedatives more frequently whilst others do not do so in a more uniform manner.

Lastly, in cases of patient discomfort during administration of anesthesia, 50% of the practitioners said that they would reassure the patient and continue with the procedure and 30 percent would change the technique and continue with the procedure, 15 percent would interrupt and provide the patient with more anesthesia, and 5 percent would interrupt and refer. It would mean that the majority of practitioners will act proactively when it comes to alleviating patient pain and proceed with the operation.

As far as knowledge is concerned, dental practitioners are well learned in the fundamentals of anesthetic principles with majority of those asked getting the right answer to most questions regarding the frequently used agents, dosing schedules and how anatomy changes affect the success of anesthesia. Although, a minor percentage of respondents did not have the level of knowledge about advanced anesthetic techniques and patient factors.

In terms of attitude, dental practitioners are mostly confident in their capacity to administer local anesthesia; anxiety and fear are noted to be a major hindrance to successful administration of anesthesia. There is also inconsistency in the frequency of practitioner interaction

in anesthesia choices with the patient, implying that communication and patient education areas can be improved.

In consideration of the practices, survey showed that, most practitioners employ the common procedures including the inferior alveolar nerve block, yet experience the problems of poor anesthesia in certain instances. The prevalent reaction of anesthesia failure is to apply further anesthetic and most of the practitioners employ further sedative to tackle the dental anxiety. Nevertheless, the extent of difference in the management of discomfort in anesthesia remains, and additional training and regularity in practices might help to improve the results.

These findings support the notion that the effectiveness of local anesthesia in dental practice can be maximized by having ongoing professional development, better communication with the patients, and regular practices.

4. Discussion

Results of this survey of local anesthesia use in dental procedures provide valuable information concerning the issues of dental practitioners. The study contributes to the knowledge base on local anesthesia in dentistry by exploring the information on knowledge, attitudes, and practices. Within the current discourse, the findings will be contrasted with six past studies to pinpoint the resemblances, differences and new trends in the area.

The survey established that Lidocaine is the most widely used agent of anesthesia by 85 percent of the practitioners. This is consistent with the results of Silva A et al. have established that Lidocaine is most commonly used as the anesthetic on different dental procedures, and its rapid onset with intermediate duration of action are the most cited reasons why it is more popular among the practitioners.[10] Nevertheless, the percentage observed in our research is slightly higher, with lidocaine being reported by 75% of the respondents, indicating a greater level of agreement on its usage.

Our research established that 60 percent of the respondents were of the opinion that Anatomical variations are the greatest factor which influences the success of local anesthesia. This is in line with the results of KT Wolf et al. which stated anatomical variability as a decisive factor in the success of local anesthetic agent use, especially in the mandibular area.[11] Nevertheless, the study conducted by Kardas P et al. resulted in the idea that drug dosage has been regarded as the most influential factor, and only 35% of the participants used anatomical variation as the main issue.[12] The difference may be explained by the regional practice differences or the differences between the sample demographics. The agreement that anatomical factors are critical is nonetheless consistent with the past research on the issues involved in providing effective anesthesia in patients with anatomical anomalies including high mandibular bone density.

Regarding the time of action duration of the local anesthetic drugs, 80 percent of the respondents accurately made the correct response of the expected time of action, 1-2 hours, which is analogous to the results of Y Sun et al. that indicated that majority of the practitioners were capable of making the right judgment on the time of action of the anesthetic drugs.[13] On the same note, 90 percent of our survey people stated sensory fibers as the main target of local anesthetics.

According to the survey, 40 percent of dental practitioners were very confident in achieving adequate local anesthesia, 35 percent were moderately confident, and 25 percent were less confident. This finding is consistent with previously reported confidence distributions. However, it is important to highlight that J Monteiro et al. had established that the more experienced a practitioner is, the more inclined he/she is to report higher confidence in administering local anesthesia, and this may be the reason why the levels of confidence in our study are in the relative range.[14]

The survey has indicated that 85 percent of the surveyed individuals acknowledged the importance of the nervousness and fear on the local anesthesia performance. This result is consistent with the results presented by VR Gadve et al.,[15] who discovered that patient anxiety has a significant influence on the perception of pain and the efficacy of anesthesia. Similar results were also described by Wang R et al., who claimed that the psychological factors are not commonly discussed in the context of anesthesia efficacy and more efforts should be directed at addressing the issue of patient anxiety.[16]

Fifty percent of the practitioners in our research stated that they always talked about anesthesia choices with patients, 35 percent talked about them occasionally and 15 percent never talked about anesthesia. The result of this finding compares to that of Baagil H et al. who established that 45 percent of practitioners never failed to discuss anesthesia options with patients, albeit the percentage was lower than in our study.[5] Regardless, Marsman M et al. observed that 20 percent of their participants said they did not even discuss anesthesia options, which is a communication gap between patients

and practitioners and should be bridged in further professional growth and training in patient education.[17]

In local anesthesia failure, 60 percent of the respondents in our survey reported administering a larger dose of anesthetic, 20 percent would seek an alternate site of injection and 10 percent would make a referral to a specialist. This is similar to those of Pennington BRT et al.[18] who observed that the general reaction to anesthesia failure involved administration of more anesthetic, with one out of five practitioners opting to do the same in other anesthetic locations. Their study showed that only 5 percent of the respondents referred the patient, which correlates with our study of 10 percent. This implies that the majority of practitioners would rather undertake corrective measures in their own practice as opposed to referring patients hence a general tendency at solving anesthesia problems without involving the specialists.

5. Conclusion

Finally, dental practitioners are showing a good knowledge of local anesthesia, especially in terms of what are commonly used and their respective effects of action. Although the majority of practitioners are assured of the use of anesthesia, psychological aspects such as patient anxiety have been identified to have an effect on its efficacy. Several practitioners actively deal with anesthesia failure by correcting dosage or injection site. Nevertheless, the process of communication with patients and regular explanations of anesthesia should be improved. The paper identifies the significance of ongoing education in the treatment of patients and innovative methods. All in all, patient engagement and psychological factors can be improved to better the success of anesthesia in dental practice.

Source of Funding

None.

Conflict of Interest

None.

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