


Dentistry students' knowledge about the use of local anesthetics

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Abstract The objective of the present study was to evaluate the knowledge of undergraduate dental students regarding the indication and use of local anesthetics in clinical and surgical procedures. This is a prospective, observational study, using a questionnaire with open and closed questions about the subject as a collection tool. After signing the ICF, 59 students who met the inclusion and exclusion criteria participated in the study by answering the questionnaire. The students included in the study had a mean age of 22.75 years, 29.31% (n=17) were male and 70.68% (n=41) were female, and one student did not declare. The average number of years in college was 4 years, with 19 students (31%) in 6th period, 22 (37.9%) in 8th period and 18 (31%) in 10th period. Fifty-seven percent identified situations related to anesthetic toxicity, 94.9% performed directed anamnesis, and 93.2% chose the anesthetic salt according to the general condition of the patient. However, when questioned about the maximum anesthetic dose in a given clinical situation, only 10.2% answered correctly. For anesthetic application procedures, 89.8% considered that controlling the volume of anesthetic solution injected was an important factor, and 72.9% informed that prior aspiration was done before starting the injection of the anesthetic. Regarding the success of the technique, 78% reported success. Considering the availability of anesthetics, the indication for patients with some systemic condition, 62.7% knew how to correctly indicate the anesthetic solution. Statistically significant differences were observed when comparing the gender of the students regarding the use of topical anesthetic ($p = 0.018$) and the use of local anesthesia for subgingival periodontal scaling ($p = 0.008$), both indications being more common in female students. It was concluded that most of the students had the necessary knowledge to choose the anesthetic salt and were successful in using the technique, however, they did not correctly calculate the maximum dose recommended for a clinical situation presented as an assumption, requiring, in this and other parameters, a review of concepts, procedures, and clinical conducts.

Descriptors: Students, Dental. Anesthesia, Local. Anesthetics.

Conocimiento de los estudiantes de odontología sobre el uso de anestésicos locales

Resumen El presente estudio tuvo como objetivo evaluar el conocimiento de estudiantes de graduación en odontología sobre la indicación y uso de anestésicos locales en procedimientos clínicos y quirúrgicos. Se trata de un estudio observacional prospectivo que utiliza como instrumento de recogida de datos un cuestionario compuesto por preguntas abiertas y cerradas sobre el tema. Después de firmar el formulario de consentimiento libre e informado, 59 estudiantes que cumplieron con los criterios de inclusión y exclusión participaron en el estudio respondiendo el cuestionario. La muestra tenía una edad media de 22,75 años, 17 (29,31%) eran del sexo masculino y 41 (70,68%) del sexo femenino, y un participante no declaró el sexo. El tiempo promedio de estudio de Odontología fue de 4 años, con 19 alumnos (31%) cursando el 6° período, 22 (37,9%) el 8° período y 18 (31%) el 10° período de la carrera. Las situaciones relacionadas con la toxicidad del anestésico fueron identificadas correctamente por 20 participantes (57,2% de los 35 que respondieron la pregunta), 56 (94,9%) realizaron anamnesis dirigida y 55 (93,2%) eligieron la sal del anestésico según el estado sistémico del paciente. Sin embargo, cuando se les preguntó sobre la dosis máxima de anestésico en una situación clínica dada, solo

6 (10,2%) respondieron correctamente. Considerando la disponibilidad de anestésicos para una extracción dental simple en pacientes hipertensos o diabéticos controlados, gestantes, lactantes y niños, poco más de la mitad de los estudiantes (62,7% a 52,5%) sabían indicar correctamente la solución anestésica, considerando la lidocaína con vasoconstrictor el anestésico de elección. Se observaron diferencias estadísticamente significativas al comparar el sexo de los estudiantes en relación con el uso de anestésico tópico ($p=0,018$) y uso de anestesia local para el procedimiento de raspado periodontal subgingival ($p=0,008$), las dos indicaciones más comunes en la porción femenina de la muestra. Se concluye que la mayoría de los académicos tienen los conocimientos necesarios para elegir la sal anestésica y lograr el uso de la técnica, sin embargo, no calcularon correctamente la dosis máxima recomendada en una situación clínica hipotética, requiriendo, en este y otros parámetros, revisar conceptos, procedimientos y enfoques clínicos.

Descriptor: Educación en Odontología. Endodoncia. Curriculum.

Conhecimento de acadêmicos de Odontologia sobre o uso de anestésicos locais

Resumo O presente estudo teve como objetivo avaliar o conhecimento de estudantes de graduação do curso de Odontologia em relação à indicação e uso dos anestésicos locais nos procedimentos clínicos e cirúrgicos. Trata-se de um estudo prospectivo, observacional tendo como instrumento de coleta um questionário composto de perguntas abertas e fechadas sobre a temática. Após assinatura do termo de consentimento livre e esclarecido, 59 acadêmicos que obedeciam aos critérios de inclusão e exclusão participaram do estudo respondendo ao questionário. A amostra apresentou média de idade de 22,75 anos, 17 (29,31%) eram do sexo masculino e 41 (70,68%) do feminino, sendo que um participante não declarou o sexo. A média de tempo cursando Odontologia foi de 4 anos, sendo que 19 alunos (31%) cursavam o 6º período, 22 (37,9%) o 8º período e 18 (31%) o 10º período do curso. Situações relacionadas à toxicidade do anestésico foram corretamente identificadas por 20 participantes (57,2% dos 35 que responderam à pergunta), 56 (94,9%) realizaram anamnese direcionada e 55 (93,2%) fizeram a escolha do sal anestésico de acordo com a condição sistêmica do paciente. Porém, quando questionados sobre a dose anestésica máxima em determinada situação clínica, apenas 6 (10,2%) responderam corretamente. Considerando a disponibilidade de anestésicos para uma exodontia simples em paciente hipertenso ou diabético controlado, gestante, lactante e criança, pouco mais que a metade dos alunos (62,7% a 52,5%) souberam indicar corretamente solução anestésica, considerando a lidocaína com vasoconstrictor o anestésico de escolha. Foram observadas diferenças estatisticamente significativas quando comparado o gênero dos acadêmicos em relação ao uso de anestésico tópico ($p=0,018$) e uso de anestesia local para o procedimento de raspagem periodontal subgingival ($p = 0,008$), sendo as duas indicações mais comuns na parcela feminina da amostra. Conclui-se que a maioria dos acadêmicos possui conhecimentos necessários para escolha do sal anestésico e sucesso quanto ao emprego da técnica, entretanto não realizaram de forma correta o cálculo da dose máxima recomendada diante de uma situação clínica hipotética, necessitando, neste e em outros parâmetros, de revisão de conceitos, procedimentos e condutas clínicas.

Descritores: Estudantes de Odontologia. Anestesia Local. Anestésicos.

INTRODUCTION

Local anesthesia is a reversible nerve conduction block, determining loss of sensation without altering the level of consciousness¹, and is an essential step in dental procedures aiming comfort and painlessness².

A good anesthetic agent should have low systemic toxicity, not be irritating to tissues, not cause permanent injury to nervous structures, and should have the shortest possible onset of anesthetic effect, sufficient duration of action and reversible action¹, requiring the use of a good anesthetic technique in the oral cavity for restorative, surgical, and other procedures, and when necessary, for the management of orofacial pain³.

The undue use of local anesthetics may cause several systemic problems⁴. Therefore, a correct and detailed anamnesis, combined with monitoring of the patient's vital signs avoid possible complications due to errors in the technique and chemical substances used. The safety of local anesthesia results from the correct total dose administered, careful technique, and slow deposition of the solution⁵.

All anesthetic solutions present some degree of vasoactivity. The presence of vasoconstrictors helps in the reduction of the dose, longer duration of anesthesia, and relative safety regarding toxicity⁶. Local anesthetic solutions used in dentistry present a great margin of clinical safety. The incidence of adverse effects is practically negligible and is due to the lack of knowledge of maximum doses of anesthetics and/or the incorrect use of anesthetic techniques by some professionals⁷. With the low incidence of neurotoxicity induced by local anesthetics, it is intriguing to speculate on the protection mechanisms that neutralize neurotoxicity related to the discrepancies among the different types of neuronal cells⁴.

Patients with concomitant somatic diseases deserve special attention in emotional control for dental treatments that cause stress, disorientation of the body's functional systems and changes in mental status⁸. Studies discuss causes and preventive care, knowledge of the anesthetic solution used and the correct technique, as well as the patient's systemic condition allied to adequate stress control before the appointment^{5,9}.

Recent studies have observed a limited scientific knowledge of anesthetic substances by dental students and surgeons, despite their routine use in the clinic^{10,11}. Professionals and students revealed great difficulty in their choice, especially when taking into consideration the systemic variables of the patient, and the type and dosage of anesthetics¹⁰.

Considering that these are the substances most used by dentists, the importance of choosing them according to the health status of patients and their contraindications is remarkable¹². There is a deficiency of understanding on the part of dental students, especially in cases related to the use of anesthetics for special patients, due to the tendency to standardize the anesthetic used in most procedures¹¹.

The objective of the present study was to evaluate the level of knowledge of dental students regarding the use and indication, protocols of the literature regarding toxicity and determination of the maximum dose of local anesthetics in their daily practice, offering elements for the correct conduction of teaching and orientation in clinical conduct.

METHODOS

This was a prospective, observational study, approved by the institutional Research Ethics Committee (CAAE no. 0303.0.115.000-11). Among the 100 students regularly enrolled in the Dentistry Course of the Federal University of Amazonas (UFAM) and who had fulfilled the prerequisites of the subjects of Applied Therapeutics in Dentistry and Oral Surgery, i.e., 32 students from the 6th period, 28 students from the 8th period and 40 students from the 10th period, 59 signed the Informed Consent Form, thus composing the study sample. Validation occurred with the prior application of the questionnaire to 10 students regularly enrolled in the course, who met the inclusion criteria for the study, who analyzed the questionnaire as to their understanding and clarity of the ideas exposed and were not included in the final sample.

The collection instrument consisted of a questionnaire containing open and closed questions about the researched theme and data related to the semester in course, age and gender. Recruitment occurred directly, with the approach of students known to be enrolled in each period selected to participate in the research, and these were personally interviewed by the calibrated applicator.

The data were analyzed using descriptive statistics. To analyze the association in relation to categorical variables, Pearson's chi-square test¹³ was used, with a 5% significance level. The software used in the analysis was Epi-Info version 3.5.3 for Windows¹⁴, which is developed and distributed free of charge by the CDC (www.cdc.org/epiinfo).

RESULTS

The sample had a mean age of 22.75 years, 17 (29.31%) were male and 41 (70.68%) female, and one participant did not declare gender. The average time of dental school was 4 years, and 19 students (31%) were in the 6th period, 22 (37.9%) in the 8th period, and 18 (31%) in the 10th period.

Regarding the knowledge about the immediate reaction to an overdose of local anesthetics, based on the 35 answers obtained, 20 (57.3%) answered that increased blood pressure, allergic reactions, and/or depression of the central nervous system could be observed. The remaining participants (n=24, 40.7%) did not know how to answer the question (Table 1).

Table 1. Distribution according to immediate or delayed reaction response for anesthetic solution overdose toxicity (n=59).

Reaction for overdose toxicity	n	%
Responded to	35	59.3
Increased blood pressure	2	5.7
Allergic reactions	4	11.4
Central nervous system depression	9	25.7
All alternatives can be observed	20	57.2
Did not answer	24	40.7

Regarding routine procedures before local anesthesia, almost all students (n=56, 94.9%) answered that they perform a directed anamnesis, and 55 (93.2%) chose the anesthetic salt according to the systemic condition of the patient. Although 44 (74.6%) of the students affirmed that they calculate the toxic dose for the patient, only 6 (10.2%) correctly answered which was the maximum dose recommended for a hypothetical clinical situation, contradicting the previous statement, showing the fragility of their clinical planning (Table 2).

Table 2. Distribution according to procedures routinely performed before anesthesia (n=59).

Variable	n	%
Directed anamnesis	56	94.9
Choice of the anesthetic salt according to the patient's general condition	55	93.2
Calculation of the anesthetic's toxic dose	44	74.6
Correctly answered which is the maximum recommended dose	6	10.2
Choice of anesthetic salt according to availability	11	18.6

Considering the availability of anesthetics for a simple exodontia in hypertensive or controlled diabetic patients, pregnant, lactating women and children, slightly more than half of the students (62.7% to 52.5%) knew how to correctly indicate the anesthetic solution, considering lidocaine with vasoconstrictor the anesthetic of choice (Table 3).

Table 3. Distribution of the correct indication of anesthetic solution in a simple exodontia for patients with some systemic condition (n=59).

Variable	n	%
Controlled Hypertension	37	62.7
Child	36	61.0
Lactating	34	57.6
Controlled Diabetic	33	55.9
Pregnant	31	52.5

When comparing the gender of the academics regarding the use of topical anesthetic and the use of local anesthesia for the subgingival periodontal scraping procedure (Table 4), statistically significant differences were observed ($p = 0.018$ and 0.008 , respectively).

Table 4. Distribution according to the use of topical anesthesia and subgingival periodontal scaling procedure (n=59).

Variable	Gender				Total	P*
	Male (n = 17)		Female (n = 41)			
	n	%	n	%		
Use of topical anesthesia	5	29.4	26	63.4	31	0.018
Subgingival periodontal scraping procedure	5	29.4	27	67.5	32	0.008

* Pearson's chi-square test

DISCUSSION

The use of local anesthetics is the most used method of pain control in dentistry, and it is considered to be easy to use and of great clinical safety^{1,5,8,15}. Several factors are important determinants of systemic toxicity of local anesthetics, such as the anesthetic salt of choice and the dose used, injection site, blocking technique, as well as several factors of the patient¹⁶.

The large number and availability of local anesthetics with specific properties and in different concentrations, onset rate, intensity, and/or duration present in the market give dental students and professionals options according to the procedure used and the patient's condition. For this, it is necessary to know the physical, systemic, and emotional characteristics of each patient by means of a detailed anamnesis⁴.

The literature reports that overdose reactions manifest clinically when blood levels of local anesthetics are high^{5,15}, which ratifies the statements reported by the students. Other signs and symptoms are also observed, such as facial tremor, anxiety, slurred speech, sweating, vomiting, loss of responses to pain stimuli, increased heart and respiratory rates, increased blood pressure, light headedness and dizziness, agitation, numbness, drowsiness, metallic taste, visual and auditory disturbances, loss of consciousness, among others, for mild to moderate levels^{5,15}. Chronic tonic convulsive activity followed by generalized central nervous system depression, decreased blood pressure, heart rate, and respiratory rate may also occur for moderate to high levels^{5,15}. However, the incidence of adverse reactions can lead to serious and even fatal situations^{4,5,15}.

Risk factors, such as preexisting neuropathies, may compromise the functional integrity of the nerve periphery and increase the predisposition to injury⁴. Local anesthetics can have toxicity to a variety of tissues and cause perioperative nerve damage, and also have vasoconstrictor properties that can cause ischemic damage, although the relevance of this mechanism for current local anesthetics is still unclear⁴.

Toxicity among local anesthetics differs according to the type of anesthetic used and is also dependent on the time and dose administered^{4,17}. Knowledge of possible technical complications and of the neurotoxic mechanisms of anesthesia is necessary to reduce complications⁴.

The relevance of the subject and the need to monitor the teaching and learning process of the curricular contents of the Dentistry Course directed the present study. The Dentistry course at UFAM underwent its curricular reformulation in 2012, however, a careful and targeted analysis in different axes of general and specific knowledge were made at the time of preparation for that reformulation¹⁸. It is extremely important that the actors involved in the academic training process are integrated in the objectives that guide the teaching-learning process, constantly evaluating its effectiveness. This study, as well as others conducted internally by each discipline¹⁹, favored a critical analysis of the points that were considered bottlenecks and that would require adjustments and redirections in the curricular reformulation process.

According to the results found, the evaluated students declared that they were able to choose the anesthetic salt according to the general condition of the patient, which reinforces the conclusions of previous studies that reveal that it is essential to evaluate the general health of the patient, making the role of anamnesis and clinical examination fundamental. Knowledge of the maximum dose shows importance in the parameters of anesthetic concentration in the solution, maximum recommended dose, and body weight of the patient, besides the use of topical anesthesia that constitutes an essential step for the application of local anesthesia, especially in pediatric dentistry^{2,7,20-22}. However, while they performed directed anamnesis and chose the anesthetic salt according to the general condition of the patient, they did not demonstrate safety in calculating the toxic dose of the anesthetic in a hypothetical clinical situation, with

only 10.2% of correct answers. Based on this observation, a surgical planning form was reinforced as a routine in which, among other aspects of the operative procedure, the anesthetic procedure is required, with data regarding the choice of anesthetic, dose calculation, indication, and recommended anesthetic technique, allowing a better preparation of the student for the execution of the procedure.

Considering the availability of anesthetics (indication for patients with some systemic condition, but controlled), the results indicate that a little more than half of the students knew how to correctly indicate the anesthetic solution, considering lidocaine as the anesthetic salt of choice. The literature postulates that patients with systemic alterations should receive dental care taking into account care in the route of administration, dose, and use of vasoconstrictors. Lidocaine is a local anesthetic widely used in dentistry because of its high tissue penetration and rapid onset of action⁶. However, the vasoconstrictor effect of epinephrine can cause high blood pressure, restricting its use in patients with hypertension and ischemic heart disease. The addition of vasopressin to lidocaine as a vasoconstrictor could allow safe dental local anesthesia in patients with cardiovascular disease⁶. Murata *et al.* (2020)²⁴ reported that the anesthetic efficacy of lidocaine was enhanced by associating 0.03 IU / mL of vasopressin. In contrast, Fujimori *et al.* (2021)⁶ found that the addition of ≤ 0.1 IU of vasopressin did not extend the anesthetic effect of lidocaine.

In case of diabetic patients, the care is related to the type of diabetes and in those who are medicated with insulin or treated with diet or hypoglycemic agents⁷. Studies show that the use of vasoconstrictors in normal patients and compensated diabetics does not cause an increase in blood glucose levels. However, others indicate a lower risk with the use of vasoconstrictors by controlled patients. Therefore, the indication of the solution for uncompensated diabetics will be prilocaine with felipressin, and local anesthetic with epinephrine for compensated patients^{7,25,26}. Diabetic peripheral neuropathy is a risk factor, because the disease stresses the nerves metabolically and hemodynamically⁴.

In controlled heart disease patients or in the elderly, the maximum dose of anesthetic containing epinephrine 1:100,000 should not exceed that contained in two tubes²⁷ and that of felipressin 0.03 IU/mL (vasoconstrictor associated with prilocaine) should be no more than the equivalent of three tubes²⁸, taking precautions with slow injection and negative aspiration²⁹, in addition to the time of service and pressure measurement. The other vasoconstrictors should not be used in patients with cardiovascular alterations. The importance of controlling the patient's anxiety should also be emphasized, since during stress there is intense release of norepinephrine and epinephrine by the adrenal glands, which, added to the vasoconstrictor present in the anesthetic solution injected, can result in significant changes in blood pressure with other complications^{27,30}.

Scientific knowledge indicates that pregnant patients can and should be cared for by dentistry professionals, selecting safe anesthetic agents, limiting the duration of care and minimizing doses, preferably scheduling procedures during the second trimester of pregnancy³¹. The anesthetic solution of choice is lidocaine with epinephrine³⁰, contraindicating the use of prilocaine due to many cases of anemia in pregnancy, which can lead to the risk of methemoglobinemia^{7,29,31}.

The dose calculation per body weight, or at least the notion of an approximate maximum volume, is essential to avoid administering doses above the maximum recommended, especially in pediatric patients³². In these patients, the risk of toxicity is greater due to their lower body weight, which is not proportionally represented by the size of the orofacial anatomy¹². The safest local anesthetic to use in the pediatric patient is lidocaine 2% with adrenaline 1:200,000³². When compared to articaine, both have satisfactory duration, but lidocaine is metabolized rapidly. The maximum recommended dose of the anesthetic solution is 5 mg/kg of body weight^{20,21}.

One proposal to improve the knowledge of students about local anesthetics is to create discussions on the subject in all curricular components during the course, including clinical activities that use anesthesiology in their procedures, so that students will be more prepared to administer anesthesia and vasoconstrictor effectively, paying attention to the anamnesis and clinical care, avoiding eventual risks of reactions and/or intercurrents^{10,12}.

CONCLUSION

The students' knowledge about local anesthetics was satisfactory. However, some of the parameters evaluated showed the need to review concepts, procedures, and clinical conducts. Most of the students had the necessary knowledge to choose the anesthetic salt, however, they did not calculate the maximum dose recommended for a hypothetical clinical situation.

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