



Knowledge and Awareness of Anaphylaxis Among Intern Dental Students in Pediatric Dentistry: A Cross-Sectional Survey Study

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Abstract

Aim: Intern dental students may encounter anaphylaxis during their clinical training, which can pose a significant risk to patient safety. This study aims to evaluate the knowledge and awareness levels of intern dental students regarding anaphylaxis in the context of clinical practice in pediatric dentistry.

Material and Method: This cross-sectional survey was conducted among fourth- and fifth-year intern dental students at the Faculty of Dentistry, Tokat Gaziosmanpaşa University, during the 2022–2023 academic year. A 15-item online questionnaire was administered to students who voluntarily agreed to participate in the study to evaluate their knowledge and awareness of anaphylaxis. The collected data were analyzed using two-way ANOVA.

Results: A total of 159 students (93%) aged between 22 and 25 years participated in this study. Among the survey participants, 6.3% reported having experienced an anaphylactic reaction during dental treatment, while 59.1% stated that they had received training in anaphylaxis management. A total of 99.4% of students recognized anaphylaxis as a life-threatening condition. No statistically significant effect was found for gender or the interaction between gender and anaphylaxis education on students' knowledge levels ($p > .05$). However, anaphylaxis education had a statistically significant main effect on knowledge levels ($p < .001$). Students who had received training in anaphylaxis management scored significantly higher (4.0 ± 1.1) compared to those without training (3.24 ± 1.8).

Conclusion: Intern dental students demonstrated strong theoretical awareness of anaphylaxis; however, gaps remain in their practical knowledge. Therefore, it is recommended that dental curricula incorporate educational programs designed to enhance practical skills alongside theoretical instruction.

Keywords: Anaphylaxis, allergy, intern dental students, pediatric dentistry

INTRODUCTION

Anaphylaxis is a rapidly occurring, systemic hypersensitivity reaction to a sensitized allergen that can be life-threatening (1). Anaphylaxis is typically mediated by immunoglobulin E (IgE); however, in rare cases, it may also occur through non-IgE mechanisms (2). Mediators released from mast cells and basophils can impact multiple organ systems, leading to a rapidly progressing condition that, if left untreated, may result in death (3). The exact incidence of anaphylaxis remains uncertain; however, recent reports indicate a marked increase in its frequency in recent years (4). According to a systematic review by the European Academy of Allergy and Clinical Immunology (EAA-

CI), the global incidence of anaphylaxis ranges from 1.5 to 7.9 cases per 100,000 person-years (5). In a ten-year retrospective analysis by Liew et al. (6), the incidence of food-related anaphylaxis increased by 350%, while drug-related anaphylaxis rose by 150%. These findings underscore the growing global burden of anaphylaxis and emphasize its emergence as a critical public health issue.

Epidemiological data on anaphylaxis in Türkiye remain limited; nevertheless, an increasing trend has been noted in emergency department visits and healthcare professionals' reports (7, 8). Food allergy-related anaphylaxis cases are frequently reported, particularly in children. However, other

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triggers, such as medications and bee stings, also represent significant causes in our country (9-11). However, aside from case reports, no comprehensive national studies on anaphylaxis have been conducted.

Anaphylaxis is a rare condition; however, incidence data indicate that it warrants attention in fields such as dentistry, where various pharmacological agents and dental materials are frequently used. According to the literature, anaphylaxis occurs at an average rate of 0.013 cases per dentist per year (12). Although the frequency of anaphylaxis in dentistry appears low, the risk remains due to the wide variety of pharmacological agents and dental materials used in practice.

Anaphylaxis typically develops within minutes of allergen exposure, with symptoms ranging from mild itching to severe respiratory failure and cardiovascular collapse. The most common manifestations of anaphylaxis include erythematous rash, urticaria, angioedema, dyspnea, wheezing, tachycardia, hypotension, nausea, and vomiting (13-15).

Potential triggers for anaphylactic reactions in dental practice include latex gloves, local anesthetics (particularly ester-group compounds), certain antibiotics, general anesthetic agents, chlorhexidine, restorative materials (e.g., acrylic monomers), and metals such as nickel and cobalt (16-21). Additionally, toothpaste, fluoride gels, and antiseptic mouthwashes may rarely trigger anaphylactic reactions in sensitive individuals (22-24).

According to current clinical guidelines, intramuscular administration of adrenaline (1:1000) is recommended at a dose of 0.5 mL for adults and children over 12 years of age, 0.3 mL for children aged 6-12 years, and 0.15 mL for children aged 6 months to 6 years, while a dose of 0.1-0.15 mL is suggested for infants under 6 months; if there is no clinical response, the dose may be repeated every 5 minutes (13,15).

Therefore, dentists' knowledge and ability to intervene are crucial in managing potential anaphylactic reactions triggered by these agents. Studies in the literature emphasize the gaps in knowledge and management skills among doctors, dentists, and other healthcare professionals regarding anaphylaxis. In particular, critical information, such as emergency protocols, adrenaline dosage, and injection sites, is not widely known (25-29). Moreover, these deficiencies have been shown to negatively affect the ability to manage medical emergencies (11, 30-32). These knowledge gaps also present a significant risk for dental students who are still developing their clinical experience. During their clinical internships, dental students handle various pharmacological and chemical agents, placing them at risk for anaphylactic reactions. Insufficient theoretical and practical training can lead to delays in effective emergency response, potentially resulting in undesirable outcomes (10, 11). A thorough understanding of anaphylaxis and the ability to apply this knowledge should be an essential component of dental education.

This study aims to evaluate the knowledge and awareness of intern dental students who have completed their clinical training in pediatric dentistry with regard to anaphylaxis. The findings are expected to contribute to the development of the dental

curriculum by identifying existing educational deficiencies. This study tested the null hypothesis that gender and educational level do not influence students' knowledge of anaphylaxis.

MATERIAL AND METHOD

Ethical Statement

Ethical approval for this cross-sectional survey study was obtained from the Clinical Research Ethics Committee of Tokat Gaziosmanpaşa University Faculty of Medicine (Approval No: 23-KAEK-088; Date: 30/03/2023). The study protocol adhered to the ethical principles outlined in the Declaration of Helsinki and followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. Before data collection, all participants were informed of the study's purpose, and written consent was obtained.

Study Design and Participants

The population for this cross-sectional survey study consisted of 171 students at Tokat Gaziosmanpaşa University Faculty of Dentistry. A total of 159 students responded to the questionnaire. The study sample size constituted 93% of the study population.

This study was conducted with volunteer intern dental students from the Faculty of Dentistry at Tokat Gaziosmanpaşa University during the 2022–2023 academic year. The target population consisted of 4th and 5th year intern dental students who had successfully completed their pediatric dentistry coursework. Only those who met the inclusion criteria and provided informed consent were included in the study.

Questionnaire and Measurements

The study questions were adapted from previously published research on anaphylaxis following a comprehensive literature review (33, 34). Students who agreed to participate completed an online questionnaire (Google Form) consisting of 15 questions assessing their demographic information, awareness, and knowledge of anaphylaxis.

The questionnaire consisted of 15 items: three questions collected demographic information, five assessed awareness of anaphylaxis-including recognition of symptoms and understanding of treatment urgency-and seven evaluated knowledge related to diagnosis, management, and appropriate epinephrine administration. In the knowledge section, each correct answer was given "1" point, while incorrect or 'don't know' answers received "0" points. The total possible score for this section ranged from 0 to 7.

Statistical Analysis

Data analysis was conducted using IBM SPSS Statistics v26 (Statistical Package for the Social Sciences, Chicago, IL, 2015). Descriptive statistics for quantitative variables were reported as mean \pm standard deviation, while categorical variables were summarized as frequency and percentage. The normality of quantitative data was assessed using the Kolmogorov-Smirnov test. The main effects and interactions of anaphylaxis training status and gender on students' knowledge were evaluated using a two-way analysis of variance (2-way ANOVA). A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 159 students (93%) participated in the study, with 59.1% identifying as female and 40.9% as male. Among the respondents, 6.3% reported witnessing an anaphylactic reaction during a dental procedure. Additionally, 59.1% reported that they had previously received training in anaphylaxis management (Table 1).

In terms of anaphylaxis awareness, 99.4% of students recognized it as a life-threatening condition and reported routinely inquiring about patients' drug allergies. While 76.1% of participants reported asking patients about possible allergies to local anesthetics, only 32.7% had inquired about allergies to other dental materials. Additionally, 97.5% stated that they would discontinue dental treatment in the event of an anaphylactic reaction during a procedure (Table 2).

Assessment of intern dental students' knowledge of anaphylaxis revealed that 93.1% recognized that it could be clinically diagnosed. Additionally, 82.4% correctly identified the initial steps of anaphylaxis treatment. However, only 57.2%

acknowledged adrenaline as the first-choice treatment. While 61% were aware that the recommended route of administration for anaphylaxis is intramuscular, only 30.8% correctly identified the M. vastus lateralis as the appropriate anatomical site for epinephrine injection. Furthermore, 35.8% accurately responded to the possibility of repeating adrenaline administration at 5-minute intervals, whereas only 10.1% knew that the pediatric dose in the Penepin® automatic injection device is 0.15 mg/0.3 ml (Table 3).

The main effects and interactions of gender and anaphylaxis education on intern dental students' knowledge levels regarding anaphylaxis are presented in Table 4. No statistically significant effect was found for gender or the interaction between gender and anaphylaxis education on students' knowledge levels ($p > .05$). However, anaphylaxis education had a statistically significant main effect on knowledge levels ($p < .001$). Students who received anaphylaxis education had an average knowledge score of 4 ± 1.1 , while those who did not scored 3.24 ± 1.8 . Overall, the students' average knowledge score was 3.7 ± 1.5 out of 7 (Table 5).

Table 1. Demographic datas of intern dental students

	Frequency (n)	Percentage (%)
Gender		
Female	94	59.1
Male	65	40.9
Have you seen a patient with anaphylaxis during dental treatment?		
Yes	10	6.3
No	149	93.7
Have you ever received education on the management of anaphylaxis?		
Yes	94	59.1
No	65	40.9

Table 2. Evaluation of anaphylaxis awareness among intern dental students

Questions	Frequency (n)	Percentage (%)
Q1. Do you think allergies can be life threatening?		
Yes	158	99.4
No	1	0.6
Q2. Before starting your dentistry procedures, do you ask your patients if they have a drug allergy?		
Yes	158	99.4
No	1	0.6
Q3. Before starting your dental procedures, do you ask your patients if they have had any allergic reactions to local anesthetics in the past?		
Yes	121	76.1
No	38	23.9
Q4. Before starting your dental procedures, do you ask your patients if they have previously had allergies to latex, chlorhexidine, formaldehyde, benzodiazepine, metal alloys, and restorative materials other than local anesthetics?		
Yes	52	32.7
No	107	67.3
Q5. If a patient has anaphylaxis during dental procedures, would you continue dental treatment?		
Yes	4	2.5
No	155	97.5

Table 3. Evaluation of anaphylaxis knowledge among intern dental students

Questions	Frequency (n)	Percentage (%)
Q1. How do you diagnose anaphylaxis?		
Clinical (at least 2 organ system involvement, such as sudden onset skin, respiratory, cardiovascular system findings), and/or laboratory findings	148	93.1
Laboratory findings (increased serum tryptase and/or histamine)	1	0.6
I don't know	10	6.3
Q2. How should the first intervention be in the treatment of anaphylaxis?		
Providing airway, respiration, and circulation. Calling emergency medical help. Intramuscular injection of the drug.	131	82.4
Calling emergency medical help. Providing intravenous access to the patient. Intravenous injection of antihistamine and corticosteroid.	23	14.5
I don't know	5	3.1
Q3. Which drug should be used as the first choice in the treatment of anaphylaxis?		
Adrenalin	91	57.2
Antihistamine	44	27.7
Corticosteroids	4	2.5
Glucagon	0	0
I don't know	20	12.6
Q4. What is the recommended route of administration of the drug as a first step in case of anaphylaxis?		
Intramuscular	97	61.0
Intravenous	41	25.8
Subcutaneous	5	3.1
I don't know	16	10.1
Q5. Which body localization is recommended for drug administration?		
M. deltoideus	56	35.2
M. vastus lateralis	49	30.8
M. gluteus maximus	12	7.5
I don't know	42	26.4
Q6. How often can drug administration be repeated?		
Cannot be reapplied	7	4.4
5 min	57	35.8
30 min	12	7.5
1 hour	3	1.9
I don't know	80	50.3
Q7. What is the child dose in the Penepin® automatic injection device?		
0.3 mg / 0.3 ml	14	8.8
0.15 mg / 0.3 ml	16	10.1
I don't know	129	81.1

**Correct answers are marked in bold*

Table 4. The effect of gender and education on intern dental students' level of knowledge about anaphylaxis

	Type III Sum of Squares	df	Mean square	F	p	Partial Eta Squared
Gender	0.082	1	0.082	0.039	0.843	0.000
Education	25.071	1	25.071	12.072	0.001	0.072
Gender*Education	0.531	1	0.531	0.256	0.614	0.002

R squared=.073 (adjusted R squared=.055)

Abbreviations: df: degree of freedom; F: two-way ANOVA test statistic

Table 5. Descriptive data on the effect of gender and education on intern dental students' knowledge about anaphylaxis

Education	Gender		Total
	Female	Male	
Yes	4 ± 1,1	4,1 ± 1,3	4 ± 1,1
No	3,3 ± 1,9	3,1 ± 1,6	3,2 ± 1,8
Total	3,7 ± 1,5	3,7 ± 1,5	3,7 ± 1,5

Mean ± standard deviation
Each participant can score a maximum of 7 points and a minimum of 0 points in this section

DISCUSSION

Anaphylaxis is a rapidly progressing immune response that can be fatal if untreated. Although rare in dental procedures, it is a critical condition requiring immediate intervention (8, 15). Local anesthetics, antibiotics, and various dental materials used in dental practice can trigger anaphylactic reactions, requiring dentists to promptly recognize and manage this condition (35). In this context, evaluating dental students' knowledge of anaphylaxis is essential for assessing the adequacy of current educational programs and identifying areas for improvement regarding potential educational deficiencies. This study aims to systematically evaluate intern dental students' knowledge, awareness, and intervention skills regarding anaphylaxis to address this educational need.

In a study by Baççioğlu et al. (36) involving dental and medical students, 94.2% of participants acknowledged that allergies can be life-threatening. Similarly, 99.4% of intern dental students in this study recognize anaphylaxis as a life-threatening condition and report routinely inquiring about patients' drug allergies. This high level of awareness is valuable, as it indicates that future dentists are mindful of the potential severity of allergic reactions and actively consider patient-specific risk factors. However, despite this high level of awareness, students' tendency to focus solely on certain agents in allergy questionnaires highlights critical shortcomings in practice.

A cross-sectional study by Krishnamurthy et al. (37) evaluating dentists' knowledge and attitudes toward anaphylaxis reported that 94.0% of respondents routinely inquired about drug allergy histories prior to initiating treatment. In the present study, 76.1% of students reported asking patients about allergies to local anesthetics, while only 32.7% inquired about potential allergies to other dental materials. However, the literature documents anaphylactic reactions associated with various dental materials, including latex, antibiotics, chlorhexidine, formaldehyde, and benzodiazepines, in addition to local anesthetics (38). These findings indicate that students tend to focus their allergy screening predominantly on local anesthetics, often overlooking other possible allergens. To reduce the risk of systemic hypersensitivity reactions, it is crucial for all dentists to obtain a comprehensive allergy history prior to treatment. Moreover, the ability to promptly recognize and effectively manage anaphylaxis is equally critical for ensuring patient safety.

Anaphylaxis is primarily diagnosed based on clinical presentation, and delays or misdiagnoses may lead to life-threatening complications such as airway obstruction or circulatory collapse (8, 15). Accordingly, it is crucial for healthcare professionals to be thoroughly familiar with the in the diagnostic criteria for anaphylaxis. In a study by Jose and Clesham (39), 97.8% of physicians and 83.7% of nurses working in emergency departments were able to correctly identify anaphylaxis. Similarly, research by Çetinkaya et al. (10), demonstrated that dentists generally recognized anaphylactic symptoms accurately (76.0%). The findings of the present study align with these results, as the vast majority of participating intern dental students reported that anaphylaxis can be clinically recognized and managed. These outcomes suggest that the level of theoretical knowledge in this area is generally sufficient.

Theoretical knowledge among students reflects an awareness of their ability to recognize anaphylaxis; however, it also underscores the need to further develop specific pharmacological and practical competencies essential for effective management. In a study assessing dental students' knowledge of anaphylaxis, 62.6% of participants identified adrenaline as their preferred first-line treatment for anaphylactic reactions (40). Similarly, in our study, over half of the participants correctly identified adrenaline as the first-line treatment (57.2%) and recognized that it should be administered intramuscularly (61.0%). In contrast, a study by Çetinkaya et al. (10), reported that only 31.5% of dentists were aware of the intramuscular route for adrenaline administration, suggesting a relatively higher level of awareness among students in our sample. However, the majority of students struggled to correctly identify the anatomical site for adrenaline administration (69.1%) and lacked knowledge about the possibility of re-administering the drug when necessary (64.2%). Furthermore, in our study, only 10.1% of participants were aware that epinephrine is available in an auto-injector for self-administration. Consistent with the findings of (7.0%) Çetinkaya et al. (10), only a small proportion of students correctly identified the pediatric dosage of Penepin® (10.1%). These findings indicate that while students possess basic pharmacological knowledge, they need further development in practical skills and clinical competencies for effective emergency intervention. Therefore, anaphylaxis management training should be reinforced not only theoretically but also through practical, scenario-based approaches.

The significantly higher knowledge scores among students who received anaphylaxis training (4.00 ± 1.1) compared to those without training (3.24 ± 1.8 ; $p < .001$) indicate that targeted education has a direct and measurable impact on knowledge acquisition. Although the study did not specifically investigate how or where the students received their anaphylaxis training, informal observations and feedback suggest that some participants had attended a voluntary seminar organized within the faculty. This implies that the training was not a standardized or mandatory part of the dental curriculum and may have been distributed unevenly across 4th- and 5th-year students. Since the academic year variable was not included in the study design, it was not possible to evaluate the effect of this difference on knowledge levels. Nevertheless, these findings further emphasize the need for structured and compulsory training programs on anaphylaxis management within dental education, ensuring that all students, regardless of academic year, are equally prepared to handle emergency situations. Notably, neither gender nor the interaction between gender and education level had a statistically significant effect on knowledge scores, suggesting that the impact of education is independent of gender (10, 32, 40). Accordingly, the null hypothesis of our study, "Gender and education level have no statistically significant effect on students' knowledge of anaphylaxis." was partially accepted. These findings are consistent with previous studies emphasizing the critical role of anaphylaxis education in clinical training (10, 27, 36, 37). They further support the notion that early recognition and effective management of anaphylaxis can be substantially improved through focused educational interventions.

This study is a cross-sectional survey conducted among intern dental students receiving training in a single city. The limited sample size and its homogeneity restrict the generalizability of the findings to the broader population of dental students. Nevertheless, this study offers a comprehensive evaluation of anaphylaxis-related knowledge and awareness among a specific group of dental students in Türkiye, examining associations with demographic variables, academic background, and clinical experience. In this regard, this study plays a valuable role in shaping educational strategies. To enhance the generalizability and robustness of these findings, future research should include larger, more diverse samples from dental schools across different regions. Furthermore, multicenter and comparative studies investigating the influence of variables such as gender, education, and clinical exposure could provide more substantial evidence for identifying and addressing educational gaps in anaphylaxis management within dental education.

CONCLUSION

This study evaluated the knowledge and awareness levels of intern dental students in pediatric dentistry regarding anaphylaxis. The findings indicated that while students demonstrated a high level of general awareness, notable deficiencies remained in critical areas such as the administration of adren-

aline. The significantly higher knowledge scores among students who had received training in anaphylaxis management highlight the effectiveness of targeted educational interventions. These findings emphasize the need to integrate both theoretical instruction and practical, scenario-based training into dental curricula to improve clinical preparedness for managing anaphylactic emergencies.

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