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Dental students' knowledge level regarding the use of antibiotics in endodontic infections in pediatric patients

Gizem Karagoz Dogan[1], Ismet Rezani Toptanci[2]
[1]Department of Pedodontics, Faculty of Dentistry, University of Igdir, Igdir, Türkiye
[2]Department of Pedodontics, Faculty of Dentistry, University of Dicle, Diyarbakir, Türkiye

ABSTRACT

Background: *Endodontic infections frequently occur in children and stand out as dental issues where antibiotics are widely favored. However, the recent overuse of antibiotics has resulted in the development of antimicrobial resistance in children. The awareness and understanding dental students have regarding the application of antibiotics for treating endodontic infections in pediatric patients have been explored in limited studies.* ***Purpose:*** *This study aims to evaluate the understanding of fourth- and fifth-year dentistry students—who are actively involved in patient care during their internships and will soon become medical professionals—about prescribing antibiotics to treat endodontic infections.* ***Methods:*** *This study was conducted using the Google Form electronic survey method on intern students at three different faculties of dentistry who have started their clinical internships.* ***Results:*** *Data were obtained from 468 participants who responded to the survey within the scope of the study. Statistically significant differences were observed in terms of knowledge level between those who were informed and those who were not about general antibiotic knowledge, prescription awareness, pediatric antibiotics dose calculations, and parenteral antibiotic applications, as well as between the places where they were informed; the same difference was observed between those who considered the information they received sufficient and those who did not ($p < 0.05$).* ***Conclusion:*** *The results of the study indicate that dental students have inadequate knowledge about the use of antibiotics in children with endodontic infections. Nevertheless, the study concludes that the knowledge level of the students can be improved through various training and educational programs.*

Keywords: *antibiotics; dental education; endodontics; medicine; pediatric dentistry*
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Correspondence: Gizem Karagoz Dogan, Department of Pedodontics, Faculty of Dentistry, University of Igdir, Merkez, Igdir, 76000 Türkiye. Email: dtgizemkaragoz@gmail.com

INTRODUCTION

In recent years, one of the most significant inventions in our lives, antibiotics, has led to the emergence of antibiotic resistance due to their incorrect and needless use.[1–3] Rational and appropriate use of antibiotics is one of the most necessary measures to reduce the development of resistance. The fundamental principles of appropriate antibiotic use include the use of the right antibiotic for the right indication, at the right time, in the right dose, and via the right route.[4–7] The increase in antibiotic use in recent years has been reported in various pieces of literature to have resulted in antibiotic resistance in children as well, which is a serious global health problem.[3,8] It has been reported that approximately 10% of all antibiotics worldwide are prescribed by dentists. Considering this figure, the role of dentists in the development of antibiotic resistance is irrefutable.[5] Antibiotics are the most frequently prescribed drugs in dentistry. The most common infections treated with antibiotics are endodontic infections associated with root canal treatment. However, antibiotic use is not always recommended for endodontic infections. Recent studies have indicated that most endodontic infections can be treated without antibiotic therapy through local interventions such as incision and drainage, root canal treatment, and tooth extraction.[3,9–11]

Antibiotic use during endodontic treatments can be considered as an adjunctive treatment option in cases where there is systemic involvement (such as fever above 38°C, malaise, cellulitis, and/or lymphadenopathy)

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despite adequate debridement and surgical drainage, or in immunosuppressed patients.[2,12,13] In cases of acute endodontic infections where adequate drainage is not possible and there is a risk of systemic spread, systemic antibiotics may be prescribed to prevent the spread of infection and the onset of serious complications.[14] Since endodontic infections are complex polymicrobial infections, broad-spectrum antibiotics should be chosen for treatment.[12,15,16] According to the American Academy of Pediatric Dentistry's (AAPD) 2020 guidelines,[17] pediatric antibiotic application and dose calculation values are critical for all pediatric dentists and general practitioners treating children. Although there exist studies that measure dental students' knowledge levels regarding antibiotic therapy, few studies assess these levels for antibiotics used to treat endodontic infections in pediatric patients.

This study aims to assess the knowledge levels of dentistry students, who will be future medical professionals, about antibiotics used to treat frequently occurring endodontic infections in children and to create awareness about their deficiencies. This study aims to educate students about the irrational habit of needlessly prescribing antibiotics and the resulting antibiotic resistance, thereby increasing their awareness.

MATERIALS AND METHODS

This study was designed as a survey for fourth- and fifth-year students studying in three different faculties of dentistry. It was decided to conduct the survey using Google Forms (Google Forms, 2018; free web-based survey form), a digital survey platform, due to the COVID-19 pandemic affecting the world. This study was conducted with the approval of the Dicle University Non-Interventional Clinical Research Ethics Committee (decision number 2019-54). The Cronbach's Alpha and validity test were applied to test the reliability and validity of the survey.

Two hundred fifty students from the fourth and fifth years of the Dicle University Faculty of Dentistry, 191 students from the Malatya Inonu Faculty of Dentistry, and 127 students from the Elazig Firat University Faculty of Dentistry were available on the date the study was conducted. The study sample comprised 468 students (82.39%), as shown in Table 1, who read the information in writing and accepted to join the study. The questions in the survey form used for data collection consisted of multiple-choice, open-ended, and yes-no questions for determining the knowledge levels and habits of the fourth- and fifth-year dentistry students about antibiotics used to treat endodontic infections in the pediatric age group. The survey forms included questions whose validity had been proven since they were used in previous similar studies.[4,18,19]

The survey included four sections: Personal Information, Personal Experience and Individual Evaluation, Case Questions 1, and Case Questions 2. Scoring was performed over the questions in the third and fourth sections of the survey to calculate the knowledge levels of the participants and for a comparative statistical analysis with the questions in the section titled Personal Information and Personal Experience—Individual Evaluation. The participants who answered correctly were awarded 1 point for the sub-questions in the Case Questions 1 section; for the multiple-choice questions in the Case Questions 2 section, they were given 0 points for each incorrect answer. The maximum score for all correct answers was 27. One open-ended question in the third section was not included in the scoring process; its statistical analysis was conducted independently.

The data obtained in this study were analyzed using the IBM SPSS 21 suite. A significance level of 0.05 was used for interpreting the results; it is stated that if $p < 0.05$, a significant relation or difference is present; if $p > 0.05$, a significant relation or difference does not exist.

RESULTS

Among the survey participants, 52.14% were female, and 47.86% were male. In the study, 212 (45.3%) participants were from Dicle University, 158 (33.76%) were from Inonu University, and 98 (20.94%) were from Firat University. Regarding grade level, 51.5% were fourth-year students and 48.5% were fifth-year students. Of the total respondents, 91.88% stated they were informed about general knowledge regarding antibiotics used in dentistry through classes, seminars, or brochures. However, 57.31% of those informed did not find the information sufficient. Among the informed participants, 97.85% were educated in classrooms. Of these participants, 80.98% stated that they were informed about prescribing antibiotics through a course, seminar, or brochure, and 93.48% revealed that they were informed through a course. Only 12.61% of the respondents believed they had sufficient knowledge about prescribing antibiotics. When answering whether they knew the pediatric dosage calculation for antibiotics used in endodontic infections, 50.85% responded with a "yes." When asked whether they knew which antibiotics to use, orally or parenterally, in patients with a penicillin allergy, 85.68% of the participants responded with a "yes." Among the participants (352 respondents) who claimed to know about the antibiotics required for patients with a penicillin allergy, 42.3% chose Clindamycin as their first option, 17.3% chose Azithromycin, and 7.69% selected Metronidazole.

The second part of the survey presented questions under subheadings based on case scenarios, with the responses given as percentages of the total number of participants (Table 1).

In the Case Questions 2 section, the first question with a checkbox option indicated that "Necrotic pulp associated with acute apical periodontitis; presence of swelling, moderate/severe pre-op symptoms" was the clinical situation resulting in the highest antibiotic prescription

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rate among participants, at 79.91%. The fourth option, "Necrotic pulp associated with acute apical periodontitis; no swelling, moderate/severe pre-op symptoms," was the clinical situation with the second most prescribed antibiotic at 38.25%. "Necrotic pulp associated with chronic apical periodontitis; presence of a sinus tract, none/minor pre-op symptoms" was the clinical situation with the least prescribed antibiotic at 8.55%.

The Case Questions 2 section further included a section with five multiple-choice questions to be answered by all participants. For the question, "In the case of endodontic infection requiring oral antibiotic prescription for a patient with no systemic disease or penicillin allergy, which would be your first choice?" 387 participants chose Amoxicillin as the correct answer, comprising 82.69% of the responses.

For the third clinical situation, "In the case of endodontic infection requiring an oral antibiotic prescription for a patient with no systemic disease but a penicillin allergy, which would be your first choice?" 360 participants selected Clindamycin as the correct answer, accounting for 76.92% of the results. In response to question four—"If you need to prescribe an oral antibiotic for an endodontic infection, which one would you choose?"—which assessed their knowledge about dosage calculation based on weight, 249 participants chose "Amoxicillin 200 mg—2 spoons," making up 53.21% of the results. The correct response, "Amoxicillin 600 mg—2 spoons," was selected by 151 participants, 32.26% of the total responses. For question five—"If you need to prescribe an antibiotic for an endodontic infection in a patient with chronic kidney failure and penicillin allergy,

Table 1. Distributions based on the answers for the cases

Cases		Yes		No		Total	
		n	%	n	%	n	%
CASE 1	Only pain	13	2.78	455	97.22	468	100
	Pain with no radiographic pathological proof and local swelling symptoms	50	10.68	418	89.32	468	100
	Pain with radiographic pathological proof and local swelling symptoms	261	55.77	207	44.23	468	100
	Pain with radiographic pathological proof and face swelling symptoms	398	85.04	70	14.96	468	100
CASE 2	Pain and fever	332	70.94	136	29.06	468	100
	Pain with no radiographic pathological proof and local swelling symptoms	206	44.02	262	55.98	468	100
	Pain with radiographic pathological proof and local swelling symptoms	334	71.37	134	28.63	468	100
	Pain with radiographic pathological proof and face swelling symptoms	423	90.38	45	9.62	468	100
CASE 3	Only pain	66	14.1	402	85.9	468	100
	Pain with no radiographic pathological proof and local swelling symptoms	114	24.36	354	75.64	468	100
	Pain with radiographic pathological proof and local swelling symptoms	194	41.45	274	58.55	468	100
	Pain with radiographic pathological proof and face swelling symptoms	338	72.22	130	27.78	468	100
CASE 4	Only pain	15	3.21	453	96.79	468	100
	Pain and local swelling symptoms	97	20.73	371	79.27	468	100
	Pain and face swelling symptoms	192	41.03	276	58.97	468	100
	Do you see the child before prescribing antibiotics?	422	90.17	46	9.83	468	100
CASE 5	Only pain	20	4.27	448	95.73	468	100
	Symptoms such as erythema and fever	205	43.8	263	56.2	468	100
	Symptoms of pain, heating of skin, and localized swelling	235	50.21	233	49.79	468	100
	Symptoms of pain, heating of skin, and face swelling	334	71.37	134	28.63	468	100
	Do you see the child before prescribing antibiotics?	442	94.44	26	5.56	468	100

Table 2. Analysis result of differences in knowledge levels based on personal information

Personal Information		Score						Analysis Result		
		n	Mean	Median	Min	Max	SD	Mean Rank	Test statistics	p
1) Gender	Male	224	20.28	21	7	26	3.82	241.1		
	Female	244	20.07	21	7	27	3.89	228.44	-1.023	0.306
	Total	468	20.17	21	7	27	3.85			
2) Faculty of Dentistry	Dicle University	212	20	21	10	24	3.86	235.89		
	Firat University	98	20.2	21	7	27	4.14	229.29	0.188	0.91
	İnonu University	158	20.39	21	8	27	3.67	235.86		
	Total	468	20.17	21	7	27	3.85			
3) Class	4^{th} year	241	20.13	21	7	27	3.73	230.32		
	5^{th} year	227	20.22	21	7	27	3.99	238.94	-0.696	0.486
	Total	468	20.17	21	7	27	3.85			

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Table 3. Analysis result of the difference between personal experiences in terms of information level

Question		Score						Analysis Result		
		n	Mean	Median	Min	Max	SD	Mean Rank	Test statistics	p
4) Have you been informed about the antibiotics used in dentistry through a class/ seminar/ brochure concerning general information before?	Yes	430	20.82	21	10	27	3.02	249.07		
	No	38	12.89	12	7	23	4.72	69.63	-7.928	0.001*
	Total	468	20.17	21	7	27	3.85			
5) If "yes," do you think it was sufficient?	Yes	181	21.85	22	14	27	2.49	253.6		
	No	243	20.11	21	10	27	3.07	181.89	-6.042	0.001*
	Total	424	20.85	21	10	27	2.96			
6) If your answer is "yes" to the 4th question, by which methods below were you informed?	Class	409	21.01	21	13	27	2.73	209.61		
	Seminar	3	20	19	16	25	4.58	171.33	0.369	0.832
	Other	6	20.5	21.5	10	26	5.58	221.42		
	Total	418	21	21	10	27	2.78			
7) Have you been informed about antibiotics prescriptions through a class/ seminar/ brochure, etc., before?	Yes	379	21.42	21	10	27	2.47	270.07		
	No	89	14.84	14	7	23	4.14	83.03	-11.873	0.001*
	Total	468	20.17	21	7	27	3.85			
8) If your answer is "yes" to the 7th question, through which methods have you been informed?	Class	330	21.81	22	14	27	2.06	182.38		
	Seminar	4	18.75	19	16	21	2.06	49.13	15.96	0.001*
	Other	19	18.95	19	10	26	4.52	110.45		
	Total	353	21.62	22	10	27	2.36		2-1 3-1	
9) Do you believe that you are at a sufficient level to prescribe antibiotics?	Yes	59	18.2	20	7	24	4.65	164.07		
	No	409	20.46	21	7	27	3.64	244.66	-4.327	0.001*
	Total	468	20.17	21	7	27	3.85			
10) Do you know how to calculate the pediatric dose of the antibiotics used in endodontic infections?	Yes	238	21.66	21	10	27	2.08	277.83		
	No	230	18.64	20	7	27	4.6	189.67	-7.129	0.001*
	Total	468	20.17	21	7	27	3.85			
11) Do you know which antibiotics should be used in an oral or parenteral route in cases where it is necessary to use antibiotics in patients with endodontic infection and penicillin allergy?	Yes	401	21.25	21	12	27	2.56	263.03		
	No	67	13.7	13	7	23	3.97	63.72	-11.292	0.001*
	Total	468	20.17	21	7	27	3.85			

*Significance level ($p < 0.05$)

Table 4 Analysis results regarding the differences in knowledge level among classes in universities

Class		Score						Analysis Result		
		n	Mean	Median	Min	Max	SD	Mean Rank	Test statistics	p
Dicle University	4th year	109	20.15	21	10	24	3.81	109.72		
	5th year	103	19.84	21	10	24	3.92	103.09	-0.794	0.427
	Total	212	20	21	10	24	3.86			
Firat University	4th year	47	19.74	21	7	26	4.01	44.28		
	5th year	51	20.63	21	7	27	4.25	54.31	-1.794	0.073
	Total	98	20.2	21	7	27	4.14			
Inonu University	4th year	85	20.32	21	10	27	3.48	76.82		
	5th year	73	20.47	21	8	26	3.91	82.62	-0.805	0.421
	Total	158	20.39	21	8	27	3.67			

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which one would you prescribe first?"—282 participants marked the correct answer Clindamycin, constituting 60.26% of the responses; 117 chose Cephalexin, making up 25%. The survey's final question—"For a patient with liver failure and a history of penicillin allergy requiring oral medication, which antibiotic would you prefer first?"—had 153 participants answering Tetracycline (excluding Doxycycline), constituting 32.69% of the results; 129 participants chose Metronidazole, accounting for 27.56%, while 60 participants selected the correct answer, Clindamycin, constituting 15.38% of the responses.

According to the scoring system described in the Materials and Methods section, the average score of 468 participants from the Case Questions 1–2 sections of the survey was 20.17. This average score was statistically compared for knowledge levels under the Personal Information and Personal Experience and Individual Assessment sections and among fourth- and fifth-year students within the same faculty (Tables 2–4). No statistically significant difference was observed in the knowledge levels between genders, dental faculties, and classes ($p > 0.05$).

The level of knowledge among those who were not informed about the general use of antibiotics in dentistry through courses, seminars, or brochures was significantly lower than those who were informed ($p < 0.05$). Those who were informed about the general use of antibiotics in dentistry through courses, seminars, or brochures and found this information insufficient had a significantly lower level of knowledge than those who found it sufficient ($p < 0.05$). There was no statistically significant difference in the level of knowledge among those who were informed about the general use of antibiotics in dentistry through various means ($p > 0.05$). The level of knowledge among those who were not informed about antibiotic prescriptions through courses, seminars, or brochures was significantly lower than those who had been informed ($p < 0.05$). Among those informed about antibiotic prescription, the level of knowledge of those educated through seminars and other means was significantly lower than those informed in a course setting ($p < 0.05$). Those who believed they were sufficiently knowledgeable about prescribing antibiotics had a significantly lower level of knowledge compared to those who did not think so ($p < 0.05$). The level of knowledge among those who did not know how to calculate pediatric antibiotic doses for endodontic infections was significantly lower than those who knew ($p < 0.05$). The level of knowledge among those who did not know which antibiotics to use orally or parenterally in patients with penicillin allergy was significantly lower than those who knew ($p < 0.05$).

DISCUSSION

Antibiotics are one of the most important groups of drugs in dentistry. The benefits of proper antibiotic use include stopping infections, preventing their spread, and minimizing serious complications.[12] However, it is well-known that a significant amount of unnecessary antibiotic prescriptions are written today for inappropriate therapeutic indications.[2] Some studies have indicated that dentists tend to prescribe antibiotics for indications that do not require them, including various stages of pulp pathology where the infection is localized, such as irreversible pulpitis. The most common infections treated with antibiotics in dentistry are endodontic infections related to root canals.[1,20]

In a study conducted by Marra et al.,[21] it was reported that the rate of antibiotic prescriptions by dentists increased by 62.2% from 1996 to 2013. It is well-established that dentists prescribe 10% of total prescribed antibiotics worldwide.[22] Considering this figure, the impact of dentists on antibiotic resistance, a global health issue, is quite significant.

Although there are studies measuring the knowledge levels of dental students regarding antibiotic therapy, there are relatively few studies that evaluate the knowledge levels of dental students about the antibiotics used in treating endodontic infections in pediatric patients. This thesis aims to assess the knowledge levels of dental internship students in faculties located in the Eastern and Southeastern Anatolia regions of Türkiye about the antibiotics used to treat endodontic infections seen in pediatric patients. This study attempted to reach fourth- and fifth-year students at Dicle University Faculty of Dentistry, Inonu University Faculty of Dentistry, and Firat University Faculty of Dentistry using electronic surveys due to COVID-19 pandemic conditions.

The rate of participants stating they were informed about prescribing antibiotics through lectures, seminars, or brochures is 80.98%. In the study by Wong et al., 69.4% of the participants answered in affirmative to this question.[18] In our research, only 12.61% of participants, a very low rate, answered "yes" to the question, "Do you believe you have adequate knowledge after antibiotic prescription training?" This rate is lower than other studies in the literature.[10,18,22,23]

The current AAPD guidelines are the reference point for diagnosis, treatment, and antibiotic use in pediatric patients with odontogenic infections.[13,17] According to the AAPD guidelines,[17] amoxicillin is the first antibiotic to be empirically chosen for treating odontogenic infections. This study also followed this guideline by choosing amoxicillin as the first choice of antibiotic. Various studies in the literature also prefer amoxicillin as the first choice.[4,19,24–27] According to the AAPD guidelines, clindamycin is one of the first two antibiotics to be preferred in cases of penicillin allergy in dental infections.[28] Similarly, in this study, clindamycin was the antibiotic of choice in such cases, which aligns with literature studies.[20,24,27,29]

The AAPD guidelines suggest that in children with endodontic infection symptoms (pain, fistula, local swelling, etc.) without systemic involvement and septicemia symptoms, treatment options such as pulpotomy,

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pulpectomy, or extraction should be considered instead of antibiotics. For endodontic infections with systemic involvement symptoms and affected neighboring tissues, oral or parenteral antibiotic therapy is indicated as an adjunct to the primary treatment.[2,17] This study evaluated compliance with AAPD guidelines through case questions. The number of students who correctly identified the options of prescribing or not prescribing antibiotics in case scenarios, in accordance with the guidelines, was very low. The compliance rate with the guidelines through these case questions is similar to that of this study in the literature.[4,18]

According to the survey, 18.59% of the participants prefer to prescribe antibiotics for irreversible pulpitis with moderate/severe symptoms. When symptomatic apical periodontitis is added, the rate of those prescribing antibiotics increases to 34.19%. The lowest preference for prescribing antibiotics (12.82%) was for options involving patients with necrotic pulp associated with chronic apical periodontitis without swelling and little or no symptoms. The highest preference for prescribing antibiotics (79.91%) was for acute apical periodontitis with swelling and moderate/severe pre-op symptoms. These findings are consistent with many studies in the literature.[19,20,23,24,26,27,30,31]

The primary cause of antibiotic resistance is the irrational use of antibiotics. The fundamental principle of rational antibiotic use is administering the right drug at the right time, with the right indication, in the right dose, and through the right route. Dental students are obligated to fulfill their responsibilities in their future professional lives.[32] Antibiotics should not be prescribed without indication; efforts should be made within dental education curricula to increase the emphasis on antibiotic use to prevent inappropriate selection of antibiotics, including inadequate or excessive dosing. Adequate training should be provided on principles of antibiotic use for the most commonly encountered endodontic infections within dental infections through seminars, conferences, and evidence-based current guidelines.

Due to the study being conducted only among students from three dental faculties, there is a limitation that the information obtained cannot be generalized for all dentistry students. Additionally, the study includes potential limitations due to the questionnaire measuring not the actual behaviors of the participants but only the behaviors they report, which might lead to tendencies of exaggerating or underreporting their real practices. Furthermore, it is essential to consider that students' educational levels and knowledge can vary throughout their education, which means the timing of the survey application could affect the responses obtained.

To enhance the generalizability of this study, new survey studies could be conducted by selecting pilot faculties from each geographical region. The survey study could be repeated annually from the first year of dental education throughout the students' years in the faculty to reassess their knowledge levels based on their years of education.

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REFERENCES

1. Teoh L, Marino RJ, Stewart K, McCullough MJ. A survey of prescribing practices by general dentists in Australia. BMC Oral Health. 2019; 19(1): 193.
2. Palmer NOA. Antimicrobial resistance and antibiotic prescribing in dental practice. Dent Update. 2016; 43(10): 954–60.
3. Inchara R, Ganapathy D, Kiran Kumar P. Preference of antibiotics in pediatric dentistry. Drug Invent Today. 2019; 11(6): 1495–8.
4. Cherry WR, Lee JY, Shugars DA, White RP, Vann WF. Antibiotic use for treating dental infections in children. J Am Dent Assoc. 2012; 143(1): 31–8.
5. Johnson TM, Hawkes J. Awareness of antibiotic prescribing and resistance in primary dental care. Prim Dent J. 2014; 3(4): 44–7.
6. Nakul G, Mohammed MS, Jameel MYS, Maryam N, Meetu A, Abdul HS. A study on the prescription pattern of drugs in Jazan general hospital, KSA. African J Pharm Pharmacol. 2016; 10(1): 7–13.
7. Prasetio E, Utami W, Othman Z, Wardani A, Rahem A, Hermansyah A. Evaluation of rational drug use based on World Health Organization prescribing indicators in a primary care center in Pamekasan East Java, Indonesia. J Basic Clin Physiol Pharmacol. 2019; 30(6): 20190326.
8. Medernach RL, Logan LK. The growing threat of antibiotic resistance in children. Infect Dis Clin North Am. 2018; 32(1): 1–17.
9. Peedikayil FC. Antibiotics in odontogenic infections - an update. J Antimicrob Agents. 2016; 2(2): 2–4.
10. AboAlSamh A, Alhussain A, Alanazi N, Alahmari R, Shaheen N, Adlan A. Dental students' knowledge and attitudes towards antibiotic prescribing guidelines in Riyadh, Saudi Arabia. Pharmacy. 2018; 6(2): 42.
11. Shetty V, Yelke S, Wahjuningrum DA, Luke AM, Testarelli L, Giardino L, Pawar AM. Post-operative quality of life after single-visit root canal treatment employing three different instrumentation techniques—An institutional randomized clinical trial. J Clin Med. 2023; 12(4): 1535.
12. Goel D, Goel G, Chaudhary S, Jain D. Antibiotic prescriptions in pediatric dentistry: A review. J Fam Med Prim Care. 2020; 9(2): 473.
13. American Association of Endodontics. AAE position statement: AAE guidance on the use of systemic antibiotics in endodontics. J Endod. 2017; 43(9): 1409–13.
14. Kaplan V, Ciğerim L, Orhan ZD, Çınarsoy Ciğerim S. Determination of preferred drugs in management of dental pain and infection. Van Med J. 2018; 25(2): 220–7.
15. Segura-Egea JJ, Martín-González J, Jiménez-Sánchez M del C, Crespo-Gallardo I, Saúco-Márquez JJ, Velasco-Ortega E. Worldwide pattern of antibiotic prescription in endodontic infections. Int Dent J. 2017; 67(4): 197–205.
16. Zubaidah N, Subiwahjudi A, Artini DD, Saninggar KE. Effectiveness of light-emitting diode exposure on photodynamic therapy against Enterococcus faecalis: in vitro study. Dent J. 2020; 53(2): 71–5.
17. American Academy of Pediatric Dentistry. Use of antibiotic therapy for pediatric dental patients. The reference manual of pediatric dentistry. Chicago, III: American Academy of Pediatric Dentistry; 2023. p. 537–41.
18. Wong Y, Mohan M, Pau A. Dental students′ compliance with antibiotic prescribing guidelines for dental infections in children. J Indian Soc Pedod Prev Dent. 2016; 34(4): 348.
19. Martín-Jiménez M, Martín-Biedma B, López-López J, Alonso-Ezpeleta O, Velasco-Ortega E, Jiménez-Sánchez MC,

DOI: 10.20473/j.djmkg.v58.i1.p45–51

Segura-Egea JJ. Dental students' knowledge regarding the indications for antibiotics in the management of endodontic infections. Int Endod J. 2018; 51(1): 118–27.
20. Germack M, Sedgley CM, Sabbah W, Whitten B. Antibiotic use in 2016 by members of the American Association of Endodontists: Report of a national survey. J Endod. 2017; 43(10): 1615–22.
21. Marra F, George D, Chong M, Sutherland S, Patrick DM. Antibiotic prescribing by dentists has increased. J Am Dent Assoc. 2016; 147(5): 320–7.
22. Konde S, Jairam L, Peethambar P, Noojady S, Kumar N. Antibiotic overusage and resistance: A cross-sectional survey among pediatric dentists. J Indian Soc Pedod Prev Dent. 2016; 34(2): 145.
23. Al Masan AA, Dummer PMH, Farnell DJJ, Vianna ME. Antibiotic prescribing for endodontic therapies: a comparative survey between general dental practitioners and final year Bachelor of Dental Surgery students in Cardiff, UK. Int Endod J. 2018; 51(7): 717–28.
24. Abuhassna MA, Aldajani HA, AlQahtani KW, Alzahrani AK, AlAwwad DA, Suliman O, Rajeh MT, Ashraf S, Al-Maweri SA. Antibiotic prescription during endodontic treatment: knowledge and practices of dental interns in Saudi Arabia. Adv Med Educ Pract. 2022; 13: 1321–8.
25. Khaloufi O, Khalaf L, Akerzoul N, Hassani FZM, Toure B. Attitudes of dental practitioners from Northern Morocco on the prescription of antibiotics during endodontic treatment: A survey. Saudi Endod J. 2022; 12(3): 316.
26. Al-Obaidi MMJ, Hadi EA, Al-Talib ZN, Daher AM, Al-Adhamy M, Ahmed HMA. Antibiotic prescription in the management of endodontic infections amongst Iraqi final-year undergraduate dental students. Brazilian J Oral Sci. 2023; 22: e230171.
27. Radeva E, Marinova-Takorova M, Radev M. A survey among dental students on their knowledge on antibiotic therapy of endodontic infection. Sylwan. 2019; 163(3): 66–76.
28. American Academy of Pediatric Dentistry. Useful medications for oral conditions. The reference manual of pediatric dentistry. Chicago, III: American Academy of Pediatric Dentistry; 2023. p. 645–52.
29. Segura-Egea JJ, Velasco-Ortega E, Torres-Lagares D, Velasco-Ponferrada MC, Monsalve-Guil L, Llamas-Carreras JM. Pattern of antibiotic prescription in the management of endodontic infections amongst Spanish oral surgeons. Int Endod J. 2010; 43(4): 342–50.
30. Basturk FB, Haznedaroglu F, Kayahan MB, Kaptan RF. Treatment approaches and antibiotic use for emergency dental treatment in Turkey. Ther Clin Risk Manag. 2013; 9: 443.
31. Figueiredo ACM, Matos IS de O, Alves BT, Vianna ME, Lins RX. Antibiotic prescription in endodontics: A transversal observational study comparing dental students and general dental practitioners in Rio de Janeiro, Brazil. Pesqui Bras Odontopediatria Clin Integr. 2023; 23: 1–12.
32. Setiabudi TO, Nasution FH. Oral hygiene assessment of dental students using the Oral Rating Index (ORI). Dent J. 2022; 55(3): 142–7.

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