

Dental Students' Knowledge about Indications of Antibiotics in the Treatment of Endodontic Infections

Çağrı Çakmakçı^{1,*}, İhya Çakmakçı², Fatih Çakıcı¹

¹Department of Endodontics, Faculty of Dentistry, Ordu University, Ordu, Turkey
²Department of Pediatric Dentistry, Faculty of Dentistry, Ordu University, Ordu, Turkey

Cite This Paper in the following Citation Styles

(a): [1] Çağrı Çakmakçı, İhya Çakmakçı, Fatih Çakıcı, "Dental Students' Knowledge about Indications of Antibiotics in the Treatment of Endodontic Infections," *Open Journal of Dentistry and Oral Medicine*, Vol. 8, No. 3, pp. 29 - 36, 2020. DOI: 10.13189/ojdom.2020.080302.

(b): Çağrı Çakmakçı, İhya Çakmakçı, Fatih Çakıcı (2020). *Dental Students' Knowledge about Indications of Antibiotics in the Treatment of Endodontic Infections*. *Open Journal of Dentistry and Oral Medicine*, 8(3), 29 - 36. DOI: 10.13189/ojdom.2020.080302.

Copyright©2020 by authors, all rights reserved. Authors agree that this article remains permanently open access under the terms of the Creative Commons Attribution License 4.0 International License

Abstract Objective: Aim of this study was to evaluate the knowledge of Ordu University, Faculty of Dentistry students about systemic antibiotic indications in endodontic infections. **Materials and Methods:** Third, fourth and fifth year students of Ordu University, Faculty of Dentistry were asked to provide an online survey about systemic antibiotic indications for the management of endodontic infections. Two hundred and sixteen students were requested to participate in this survey. Descriptive statistics, chi-square test and Fischer's exact test were used to analyze the data. Significance level was set at $P < 0.05$. **Results:** One hundred eighty-five students (85.6%) answered the questions satisfactorily. The most preferred antibiotic prescribing duration was determined as 7 days (42.2%). Among all respondents, the most preferred antibiotics in adult patients not allergic to penicillin were Amoxicillin + Clavulanic acid 1gm (31.4%) and Amoxicillin 500mg (18.4%), respectively. The most preferred antibiotic in patients with allergies to penicillin was Clindamycin 600mg (58.4%). In symptomatic apical periodontitis (SAP) cases with necrotic pulp, moderate/severe symptoms and no swelling, 11.4% of the respondents prescribed antibiotics, while 64.9% of the respondents prescribed antibiotics at SAP cases with necrotic pulp, swelling and moderate/severe symptoms. **Conclusion:** Dental students showed satisfactory knowledge about antibiotic prescribing in endodontic infections when compared to their peers in other studies. Specific aspects of antibiotic prescribing knowledge that needs improvement include types of antibiotics and

indications for antibiotic prescribing in endodontic infections.

Keywords Antibiotics, Endodontic Infections, Dental Students, Dental Survey

1. Introduction

Antibiotics are drugs that are commonly used for prevention and treatment of bacterial infections. Depending on the excessive consumption of these drugs, antibiotic resistance (AR) occurs with chromosomal and genetic changes in bacteria [1]. AR is currently a major global health emergency. Resistance mechanisms exist for all antibiotics currently in use. Unfortunately, very few new drugs are in the pipeline [2]. AR causes an increase in hospital treatment times, medical costs and mortality rates. The dangerous increase in AR becomes an international problem and hinders the fight against common infectious diseases. If the use of antibiotics is not limited, AR will remain as a major threat even if new drugs are developed [3, 4]. Besides to AR, antibiotic use can lead to other morbidities like systemic complications, and allergy [5].

As in many other countries, unnecessary or improper use and related problems of irrational use of antibiotics are common in Turkey. According to the Republic of Turkey Ministry of Health's [6] 2019 data, it is estimated

that 25% of prescriptions contained antibiotics in 2017. Antibiotic consumption in 2018 is estimated to be 166 million on a box basis. AR, which is an important national health problem in our country, is still a more serious problem.

Antibiotics have an important place among the drugs prescribed by dentists[7]. Therefore, dentists have an important role in rational use of antibiotics. Firstly, the dentist must have sufficient pharmacology knowledge of these medicines and be careful not to use antibiotics indiscriminately. The clinician should determine the choice of antibiotics according to the indications in clinical scenarios, evaluate the suitability of the antibiotic planned to be prescribed to the patient, complete other treatment procedures and recommendations rather than medications [8]. At the same time, the clinician should write a prescription in the correct format and content, and inform the patient sufficiently.

Endodontic infections can often be successfully treated without medications. However, in cases where the infection progresses rapidly and systemic spread occurs, antibiotics can be used in addition to local treatment.

In a study published recently[9], it was stated that the use of systemic antibiotics is not required in the following cases: SAP (only with pain), pulp necrosis, SAP (pain, percussion pain and dilation of the periodontal ligament space), chronic apical abscess (sinus tract and periapical radiolucent teeth), acute apical abscess without systemic involvement (localized fluctuant swelling).

Degree program guidelines of the European Society of Endodontology (ESE)[10] for endodontics provide a list of qualifications expected by graduated dental students. According to these guidelines, students should know the factors related to the success of root canal treatment and the prognosis of the teeth and should consider these in the decision-making process. The students should also have a deep knowledge of pharmacological agents and therapeutics used in endodontic infections.

Dental students are future dentists and they should have been aware of the use of antibiotics and the mechanisms and importance of antimicrobial resistance in the treatment of microbial infections.

The purpose of this study is to assess knowledge levels of Ordu University, Faculty of Dentistry students about systemic antibiotic indications in the treatment of endodontic infections.

2. Materials and Methods

This study was a cross-sectional survey study applied to Ordu University Faculty of Dentistry students in 2020. The study was approved by Ordu University Clinical Research Ethics Committee (2020/199). Clinical internships start from the third year in Ordu University Faculty of Dentistry, so third, fourth and fifth year students were asked to answer an online survey about antibiotic

indications in the treatment of endodontic infections. (Figure 1). Respondents were required to be registered to undergraduate courses of the related department.

ANTIBIOTICS IN ENDODONTIC INFECTIONS

1. E MAIL ADDRESS: _____
2. GENDER: MALE FEMALE
3. AGE: < 23 23-25 >25
4. CLASS: 3 4 5
5. When systemic antibiotics are indicated, which antibiotic would you choose for the treatment of an endodontic infection in an adult patient with no medical allergies?

- Amoxicillin 500mg
 Amoxicillin 1gr
 Amoxicillin+Clavulanic acid 625mg
 Amoxicillin+Clavulanic acid 1gr
 Clindamycin 300mg
 Clindamycin 600mg
 Azithromycin 250mg
 Azithromycin 500mg
 Metronidazole+Streptomycin
 Others _____

6. For how many days would you prescribe antibiotics?

- ≤ 3
 4-6
 7
 >7

7. When systemic antibiotics are indicated, which antibiotic

would you choose for the treatment of an endodontic infection in an adult patient with allergy to penicillin?

- Clindamycin 300mg
 Clindamycin 600mg
 Azithromycin 250mg
 Azithromycin 500mg
 Metronidazole+Streptomycin
 Erythromycin
 Lincomycin
 Other _____

8. In which of the following situations do you consider that antibiotics are indicated? Check all that apply.

- IP; moderate/severe pre-op symptoms
 IP with SAP; moderate/severe pre-op symptoms
 NP with AAP; no swelling, no/mild pre-op symptoms
 NP with AAP; sinus tract
 present; no/mild pre-op symptoms
 NP with SAP; swelling
 present; moderate/severe pre-op symptoms

Figure 1. Antibiotic survey

The questionnaire was created based on the questions in the surveys conducted in European countries[11, 12]. An online web link containing the questionnaire was created via the Google / Forms application. The web link was activated for 3 months between 01.09.2020-01.12.2020 and the participated students filled the questionnaire voluntarily. Students who did not consent to participate to survey were not included to the study.

3. Statistical Analysis

The database collected in the Google forms application were converted to Excel format (Microsoft Corp., Redmond, WA, USA) for further analysis. Then, the data were analyzed using IBM SPSS Statistics Package (Version 22.0. Armonk, NY: IBM Corp.). Descriptive statistics, chi-square test and Fischer's exact test were applied to the groups. Mann-Whitney U test was used for pairwise comparison with bonferroni correction. Power sample of the data was examined using the chi-square likelihood-ratio. Statistical significance level was set at

P<0.05.

4. Results

After all, one hundred eighty five students succeeded in answering the questionnaire satisfactorily. Demographic informations and also distribution by years of 185 respondents are shown in Table 1. The total of male respondents (n = 65) in the survey were 35.1%, and the total of female respondents (n = 120) were 64.9%.

Table 1. The demographic profile of respondents (n=185).

GENDER	RESPONDENTS
Male	65 (31.1%)
Female	120 (64.9%)
YEAR	RESPONDENTS
3	81 (43.8%)
4	52 (28.1%)
5	52 (28.1%)
AGE	RESPONDENTS
< 23	124 (67.0%)
23-25	57 (30.8%)
> 25	4 (2.2%)

The most preferred antibiotic prescribing duration was

7 days with 42.2% (Figure 2). This was followed by 41.1% over 4-6 days. There was no statistically significant difference between junior (3rd year) and senior (4th and 5th years) students in comparison of preferences between classes (P=0.074). The most preferred antibiotic in adult patients not allergic to penicillin was Amoxicillin + Clavulanic acid 1gm (31.4%). Secondly, Amoxicillin 500mg was preferred with 18.4% (Table 2). There was a statistically significant difference in the preferences of junior and senior students (P =0.00006). While 64.1% of junior students prescribed Amoxicillin, this rate was 99.1% in senior students. In the prescription of adult patients who are not allergic to drugs, there was no drug preference except for Amoxicillin in 5th year students, while only one person preferred Clindamycin 300mg in 4th year students. The majority of the respondents chose Clindamycin 600mg (58.4%) as the most preferred antibiotic in the patients who are allergic to penicillin (Table 2). The preferences of junior students were statistically significant when compared with senior students (P=0.02). While 43.3% of junior students prescribed Clindamycin, this rate was 92.3% in senior students

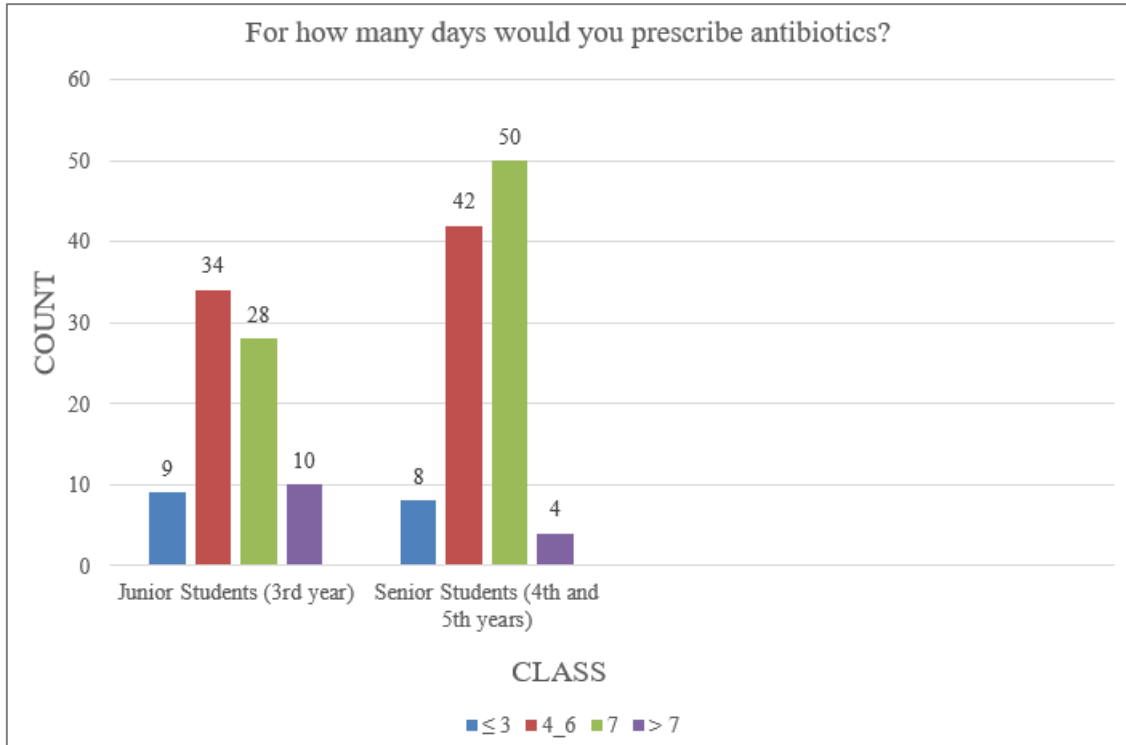


Figure 2. Distribution of respondents by treatment duration.

Table 2. Antibiotic preferences of respondents in endodontic infections (%).

	Antibiotic	Dose	Frequency (n=185)	Valid Percent
Patients without penicillin allergy	Amoxicillin	500mg	34	18.4
	Amoxicillin	1gm	32	17.3
	Amoxicillin+Clavulanic Acid	625mg	31	16.8
	Amoxicillin+Clavulanic Acid	1gm	58	31.4
	Clindamycin	300mg	8	4.3
	Clindamycin	600mg	11	5.9
	Azithromycin	250mg	5	2.7
	Azithromycin	500mg	3	1.6
	Metronidazole+Spiramycin	-	3	1.6
	Other	-	-	-
Patients with penicillin allergy	Clindamycin	300mg	23	12.4
	Clindamycin	600mg	108	58.4
	Azithromycin	250mg	6	3.2
	Azithromycin	500mg	8	4.3
	Metronidazole+Spiramycin	-	8	4.3
	Erythromycin	-	29	15.7
	Lincomycin	-	3	1.6
	Other	-	-	-

Table 3. Antibiotic prescribing in specific clinical scenarios

	YES	NO	P
IP*; moderate/severe pre-op symptoms	11.4%	88.6%	0.002*
IP with SAP*; moderate/severe pre-op symptoms	28.6%	71.4%	0.870
NP* with AAP*; no swelling, no/mild pre-op symptoms	6.5%	93.5%	0.134
NP with SAP; no swelling, moderate/severe pre-op symptoms	11.4%	88.6%	0.244
NP with AAP; sinus tract present; no/mild pre-op symptoms	9.7%	90.3%	0.324
NP with SAP; swelling present; moderate/severe pre-op symptoms	64.9%	35.1%	0.001*

* IP, irreversible pulpitis; NP, necrotic pulp; SAP, symptomatic apical periodontitis; AAP, asymptomatic apical periodontitis.

Antibiotic choices specific to the cases were given in Table 3. In cases of irreversible pulpitis (IP) with moderate / severe symptoms, 88.6% of the respondents did not prefer to prescribe antibiotics. In the pairwise comparison, a statistically significant difference was

found between junior and senior students ($P=0.002$). While 80.2% of junior students did not prescribe antibiotics in this clinical scenario, 95.2% of senior students did not prescribe antibiotics.

In the SAP cases with necrotic pulp and swelling, 64.9% of the respondents prescribed antibiotics. In the pairwise comparison, a statistically significant difference was found between the junior and senior students. ($P=0.001$). While 50.6% of junior students prescribed antibiotics in this clinical scenario, 76% of senior students prescribed antibiotics.

In the case of IP with moderate / severe symptoms, a statistically significant difference was found when comparing by gender for antibiotic prescription preference ($P=0.013$). In the first case, 20% of male respondents stated that antibiotics were indicated, while only 6.7% of female respondents prescribed antibiotics (Figure 3). No significant difference was found in comparing by age and gender in antibiotic selections specific to other cases ($P>0.05$).

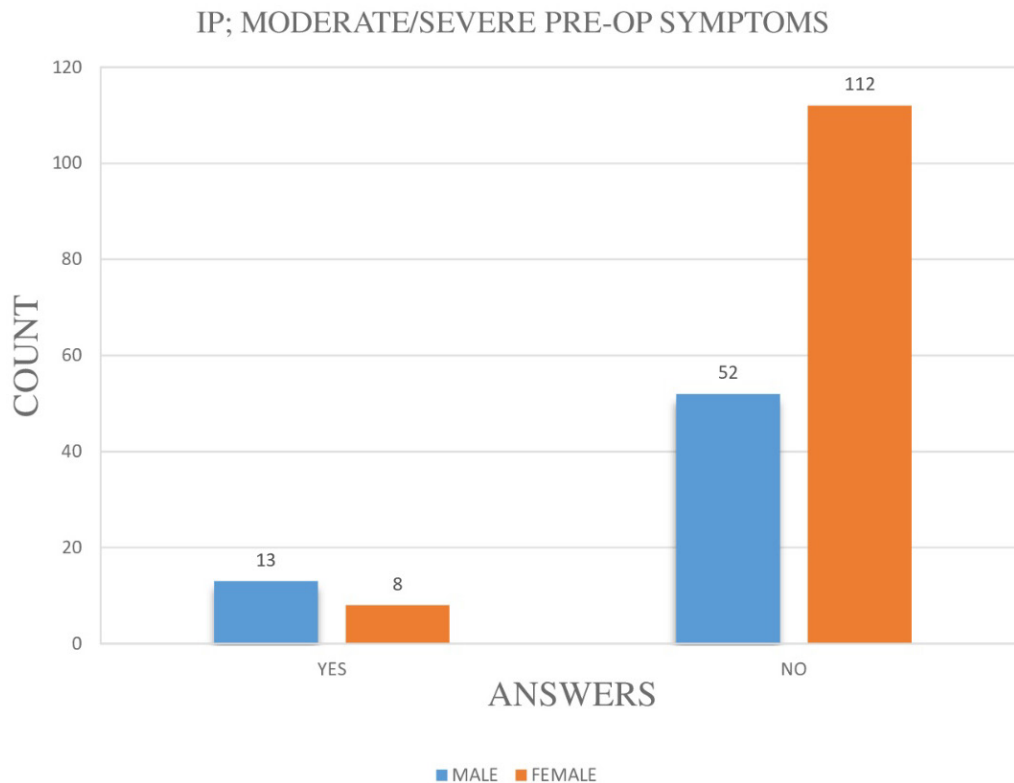


Figure 3. Comparison of the antibiotic prescription preferences by gender in the case of IP with moderate / severe symptoms.

5. Discussion

The results of this study provide comprehensive data on the knowledge of dental students of Ordu University on antibiotic use in endodontic infections. The results also identify issues where knowledge aspects that need improvement to enhance future dentists' antibiotic prescribing practices.

Overall, 185 students from Ordu University Faculty of Dentistry attended to the survey. In this survey, which was widely responded, all of the participating students were regularly attending to the classes. The data were analyzed according to gender, age, year, the most preferred antibiotic (beta-lactam antibiotic), duration of antibiotic treatment, and case specific antibiotic selections.

The most recommended duration of antibiotic treatment by students was 7 days (42.2%). In addition, 41.1% of the students indicated a treatment between 4-6 days, 7.6% chose a period of >7 days. In similar surveys[11, 12], 99% of Italian students prescribed antibiotics for 3-7 days, while %69 of Spanish students prescribed antibiotics for 7 days. In general, endodontic infections take 3 to 7 days with a rapid onset, so both options were compatible with the literature, but less than 7 days of treatment were indicated[13].

Amoxicillin was stated as the most preferred antibiotic by 83.9% of the students who participated in our survey. While 35.7% of the students stated that Amoxicillin should be applied alone, 48.2% thought that it should be

prescribed together with Clavulanic acid. In the study conducted with Spanish students[11], the most preferred antibiotic Amoxicillin was chosen by 100% of the respondents. Also amoxicillin was selected as the first preferred antibiotic with 98.7% in the study conducted with Italian students[12]. In a study conducted with Turkish general dental practitioners[14], frequently preferred antibiotics were Amoxicillin + Clavulanic acid with 61.8% and Amoxicillin alone with 46.5%. Penicillin is still the gold standard for treating dental infections[15]. We can confirm with the literature that the first preferred antibiotic in the treatment of endodontic infections is Amoxicillin, used alone or in combination with Clavulanic acid[9]. Our students' preferences were in line with similar studies and the literature.

Amoxicillin, a mid-spectrum beta-lactam antibiotic, is suitable for endodontic infections [13, 16]. However, in the presence of beta-lactamase-producing bacteria, the effectiveness of amoxicillin is considerably reduced. Therefore, amoxicillin is used with Clavulanic acid to increase its bactericidal activity[17].

Clindamycin is the first-choice antibiotic in patients allergic to beta-lactam antibiotics, and 70.8% of students stated that they preferred this drug. While 99% of Spanish students[11] prescribe 300 mg Clindamycin, only 11.9% of Italian students[12] are reported to prescribe Clindamycin. Clindamycin has been reported as the most prescribed antibiotic in patients with penicillin allergy in odontogenic infections[18, 19]. The use of clindamycin is

recommended in patients with beta-lactam allergy and our results follow this information[9]. On the other hand, serious side effects such as pseudomembranous colitis, anaphylaxis, Sweet's syndrome and myelosuppression should be considered in its use[20]

According to the studies[14, 21] examining the knowledge and practices of Turkish dentists about antibiotics, it was seen that there are problems such as inappropriate antibiotic use, insufficient informing of the patients, and irrational drug use. It was determined that overprescribing antibiotics for cases where local treatments would be sufficient, and it was concluded that undergraduate and graduate education should be reviewed.

It is clear that dentists need to change their habit of prescribing antibiotics. Therefore, it is very important to increase the knowledge of dental students about antibiotics.

In this study, the percentages of antibiotic choices out of six cases reveal students' knowledge about the use of antibiotics in endodontic infections and enable the necessary improvements in the education curriculum. In the cases of first and second questions, that is IP with moderate/severe symptoms or IP with SAP, 11.4% and 28.6% of students, respectively, would prescribe antibiotics. In a study with Turkish dentists[14], 26.5% of dentists prescribed antibiotics in IP cases, similar to the results of our survey. However, it is not correct to prescribe antibiotics in these cases[13, 22, 23]. This result shows that our students should review their knowledge about the use of antibiotics in endodontics. The difference between junior and senior students may be due to senior students having more clinical experience.

In recent study, 6.5% of students would prescribe antibiotics in a patient with necrotic pulp, AAP, no swelling, no/mild symptoms. However, it is not correct to prescribe antibiotics in this case either[13, 23]. Root canal treatment would be sufficient to treat this case successfully. In the same question, the rate of Spanish students[11] prescribing antibiotics was 14%.

In case four, necrotic pulp and SAP with moderate/severe symptoms but no swelling, there is no need to prescribe antibiotics[13, 23]. Only 11.4% of students prescribe antibiotics to a patient with these clinical signs. While this rate was determined as 44% in a study with Spanish students[11] and 37.2% of the respondents prescribed antibiotics in a study with Turkish dentists[14]. Compared to these rates, we can say that our students' preferences are largely correct.

A case of AAP, with a necrotic pulp and sinus tract, requires only root canal treatment, but no antibiotics[13, 23]. Only 9.7% of our students prescribed antibiotics in this case. In a study conducted in Spain[11], 38% of students prescribed antibiotics in the same situation. This result seems to be largely compatible with the literature.

The final case, a necrotic pulp, SAP, swelling and moderate/severe symptoms, was treated with antibiotics by 64.9% of our dental students. In a similar study[11], this rate is 90%. In cases with systemic spread, antibiotics may be recommended in addition to root canal treatment[13, 23, 24]. Therefore, this rate could be expected to be higher. The difference between junior and senior students may be due to the clinical experience of senior students.

Endodontic infections are polymicrobial conditions in which both gram negative and gram positive bacteria play a role, with the most anaerobic bacteria and partially facultative bacteria. There is no need to use systemic antibiotics in healthy individuals with localized swelling, chronic apical abscess with sinus tract, after endodontic surgery or without systemic spread. It is pointless to prescribe antibiotics, especially when there are no signs of systemic infection for pulpitis cases[8, 25].

The results of our study indicate that our students should improve their knowledge about antibiotics. In endodontic emergencies, case management should be taught with interactive applications and pharmacology courses should be emphasized and students' drug information should be reinforced. One reason for overprescribing antibiotic may be pressure and intense demand from patients[15]. It is not really easy to explain to patients and their relatives that dental pain is mostly inflammatory processes, and that it can usually be suppressed with analgesic drugs[26]. In order to combat this pressure created by the patients, it would be beneficial for dental students to graduate better about effective antimicrobial drug use and follow the regularly updated guidelines.

6. Conclusions

Dentists are expected to be competent in prescribing in addition to their operative skills. While global rates of antibiotic resistance are alarming, dentists should also avoid prescribing unnecessary antibiotics. Under this study limitation, it can be concluded that students should receive education in line with international prudent antibiotic prescribing guidelines that are constantly updated and follow the continuous developments after graduation. It is recommended that a similar survey is conducted countrywide among dental students to evaluate their knowledge on antibiotic prescribing in a more accurate and applicable guidelines.

Acknowledgements

As the authors, we would like to thank all the academicians who contributed to our study and all of our students who gently participated in our survey.

Conflicts of Interest

As the authors, we would like to state clearly that there are no conflicts of interest regarding this article.

REFERENCES

- [1] Neu HC. The crisis in antibiotic resistance. *Science (New York, N.Y.)*; 257(5073): 1064–73 1992 [https://doi.org/10.1126/science.257.5073.1064] [PMID: 1509257]
- [2] Blair JMA, Webber MA, Baylay AJ, Ogbolu DO, Piddock LJV. Molecular mechanisms of antibiotic resistance. *Nature Reviews Microbiology*; 13(1): 42–51 2015 [https://doi.org/10.1038/nrmicro3380] [PMID: 25435309]
- [3] World Health Organization (WHO), "Antibiotic resistance", WHO. <https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance> (accessed July 31, 2020).
- [4] Frieri M, Kumar K, Boutin A. Antibiotic resistance. *Journal of infection and public health*; 10(4): 369–78 2017 [https://doi.org/10.1016/j.jiph.2016.08.007] [PMID: 27616769]
- [5] Dar-Odeh N, Fadel HT, Abu-Hammad S, Abdeljawad R'a, Abu-Hammad OA. Antibiotic Prescribing for Oro-Facial Infections in the Paediatric Outpatient: A Review. *Antibiotics (Basel, Switzerland)*; 7(2): 38 2018 [https://doi.org/10.3390/antibiotics7020038] [PMID: 29693642]
- [6] Koca F., "Sağlık Bakanı Dr. Fahrettin Koca'nın Akılcı Antibiyotik Kullanıma Yönelik Açıklaması", TC Sağlık Bakanlığı. <https://www.saglik.gov.tr/TR,55308/saglik-bakani-dr-fahrettin-kocanin-akilci-antibiyotik-kullanima-yonelik-aciklamasi-02052019.html> (accessed May 2, 2019).
- [7] Sweeney LC, Dave J, Chambers PA, Heritage J. Antibiotic resistance in general dental practice--a cause for concern? *The Journal of antimicrobial chemotherapy*; 53(4): 567–76 2004 [https://doi.org/10.1093/jac/dkh137] [PMID: 14985274]
- [8] Aydın M., Koyuncuoğlu CZ., Kılboz MM, Akıcı A. "The Rational Use of Antibiotics in Dentistry: Review". *Türkiye Klinikleri J Dental Sci (Türkiye Klinikleri Journal of Dental Sciences)*; 23(1): 33–47 2017 [https://doi.org/10.5336/dentalsci.2015-47189]
- [9] Segura-Egea JJ., Gould K., Şen BH., Jonasson P., Cotti E, Mazzoni A, Sunay H, Tjäderhane L, Dummer PMH. "European Society of Endodontology position statement: the use of antibiotics in endodontics". *International endodontic journal*; 51(1): 20–5 2018 [https://doi.org/10.1111/iej.12781] [PMID: 28436043]
- [10] Moor RD., Hülsmann M., Kirkevang LL., Tanalp J., Whitworth J. "Undergraduate curriculum guidelines for endodontology". *International endodontic journal*; 46(12): 1105–14 2013 [https://doi.org/10.1111/iej.12186] [PMID: 24117830]
- [11] Martín-Jiménez M., Martín-Biedma B., López-López J., Alonso-Ezpeleta, O., Velasco-Ortega E, Jiménez-Sánchez MC, Segura-Egea JJ. "Dental students' knowledge regarding the indications for antibiotics in the management of endodontic infections". *International endodontic journal*; 51(1): 118–27 2018 [https://doi.org/10.1111/iej.12778] [PMID: 28375572]
- [12] Salvadori M., Audino E., Venturi G., Garo ML., Salgarello, S. "Antibiotic prescribing for endodontic infections: a survey of dental students in Italy". *International endodontic journal*; 52(9): 1388–96 2019 [https://doi.org/10.1111/iej.13126] [PMID: 30982994]
- [13] Segura-Egea, JJ., Gould K., Şen, BH, Jonasson P., Cotti, E., Mazzoni A, Sunay H, Tjäderhane L, Dummer PMH. Antibiotics in Endodontics: a review. *International endodontic journal*; 50(12): 1169–84 2017 [https://doi.org/10.1111/iej.12741] [PMID: 28005295]
- [14] Kaptan RF., Haznedaroglu F., Basturk FB., Kayahan MB. "Treatment approaches and antibiotic use for emergency dental treatment in Turkey". *Therapeutics and clinical risk management*; 9: 443–9 2013 [https://doi.org/10.2147/TCR.M.S52009] [PMID: 24307834]
- [15] Dar-Odeh NS, Abu-Hammad OA, Al-Omiri MK, Khraisat AS, Shehabi AA. Antibiotic prescribing practices by dentists: a review. *Therapeutics and clinical risk management*; 6: 301–6 2010 [https://doi.org/10.2147/tcrm.s9736] [PMID: 20668712]
- [16] Skucaite N., Peciliene V., Vitkauskiene A., Machiulskiene V. "Susceptibility of endodontic pathogens to antibiotics in patients with symptomatic apical periodontitis". *Journal of endodontics*; 36(10): 1611–6 2010 [https://doi.org/10.1016/j.joen.2010.04.009] [PMID: 20850663]
- [17] Grayson LM. "Antibiotics", *Kucers' The Use of Antibiotics: A Clinical Review of Antibacterial, Antifungal and Antiviral Drugs*, 6th ed, 2010, 65. 5-190.
- [18] Guzmán-Álvarez R., Medeiros M., Lagunes LR., Campos-Sepúlveda Ae. "Knowledge of drug prescription in dentistry students". *Drug, healthcare and patient safety*; 4: 55–9 2012 [https://doi.org/10.2147/DHPS.S30984] [PMID: 22807647]
- [19] Jain A., Gupta D., Singh D., Garg Y., Saxena A., Chaudhary H., Singh A., Gupta RK. "Knowledge regarding prescription of drugs among dental students: A descriptive study". *Journal of basic and clinical pharmacy*; 7(1): 12–6 2015 [https://doi.org/10.4103/0976-0105.170584] [PMID: 26792957]
- [20] Ramadan AM, Al Rikaby OA, Abu-Hammad OA, Dar-Odeh NS. Knowledge and Attitudes Towards Antibiotic Prescribing Among Dentists in Sudan. *Pesquisa Brasileira em Odontopediatria e Clínica Integrada*; 19(1): 1–10 2019 [https://doi.org/10.4034/pboci.2019.191.17]
- [21] Sermet S., Akgün MA., Atamer Ş. "Antibiotic Prescribing Profile in The Management of Oral Diseases Among Dentists in Istanbul". *Journal of Marmara University Institute of Health Sciences*; 1(1): 35–41 2011 https://scholar.google.com/scholar?hl=tr&as_sdt=0%2C5&q=Antibiotic+Prescribing+Profile+in+The+Management+of+Oral+Diseases+Among+Dentists+in+Istanbul&btnG=

- [22] Keenan JV., Farman AG., Fedorowicz Z., Newton JT. "A Cochrane systematic review finds no evidence to support the use of antibiotics for pain relief in irreversible pulpitis". *Journal of endodontics*; 32(2): 87–92 2006 [<https://doi.org/10.1016/j.joen.2005.10.029>][PMID: 16427452]
- [23] Fedorowicz Z., van Zuuren EJ., Farman AG., Agnihotry A., Al-Langawi, Jassim Hasan. "Antibiotic use for irreversible pulpitis". *The Cochrane database of systematic reviews*; (12): CD004969 2013 [<https://doi.org/10.1002/14651858.CD004969.pub3>][PMID: 24353116]
- [24] Yingling NM., Byrne BE., Hartwell GR. "Antibiotic use by members of the American Association of Endodontists in the year 2000: report of a national survey". *Journal of endodontics*; 28(5): 396–404 2002 [<https://doi.org/10.1097/00004770-200205000-00012>][PMID: 12026927]
- [25] Combating antibiotic resistance. *Journal of the American Dental Association* (1939); 135(4): 484–7 2004 [<https://doi.org/10.14219/jada.archive.2004.0214>][PMID: 15127872]
- [26] Lewis MAO. Why we must reduce dental prescription of antibiotics: European Union Antibiotic Awareness Day. *British dental journal*; 205(10): 537–8 2008 [<https://doi.org/10.1038/sj.bdj.2008.984>][PMID: 19023306]