

Pattern of antibiotics prescription by endodontists for root canal infections in Saudi Arabia

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ABSTRACT

Background: Antibiotic resistance is a severe worldwide health concern caused by inappropriate use of antibiotics. In most cases, pulp inflammations caused by a root canal system infection do not necessitate the administration of systemic antibiotics to assess the prescriptions' attitude of the endodontist and general dentist towards antibiotics during endodontic treatment. **Methodology:** Between September 2020 and October 2021, a descriptive study was conducted in Saudi Arabia. Depending on a designed questionnaire distributed to general dentists, endodontists in Al-Qassim Province. Data was gathered and entered into the "Microsoft Office excel software" (2016) for Windows program, which was then analyzed using the (SPSS) program. **Results:** 75.3 % of the 792 participants in the study were males, and 24.7 % were girls. 40.2 % of the study's sample was between the ages of 20 and 25, and 31.4 % was between the ages of 26 and 30. Buraydah has 37.4 %, while Al-Rass has 30.3 %. 61.6 % graduated after 2015, while 19.4 % graduated between 2010 and 2015. Amoxicillin dose prescribed for adults with no allergy was reported to be 500 mg by 66.2% of participants. Amoxicillin + clavulanic acid dose prescribed for adults with no allergy was reported 500mg by 66.3%. **Conclusion:** In conclusion, Saudi endodontists and dentists follow worldwide guidelines when prescription antibiotics. There were, however, instances of unsuitable prescriptions, as in the case of patients who have irreversible pulpitis, necrotic pulps with no systemic involvement, and/or sinus tracts. Antibiotics and their indications in endodontics must be better understood by endodontist and dentists.

Keywords: Antibiotics Prescription, Root canal Infections, Endodontist

1. INTRODUCTION

Pain and pulp inflammation related to the root canal system infection in most situations don't necessitate the use of systemic antibiotics. On the opposite

side, an operative intervention to relieve symptoms is enough in most cases (Chowdhury & Chakraborty, 2017). So, the endodontic infection is treated with systemic antibiotics has been a dangerous phenomenon in recent years because of excessive antibiotic use. This will lead to consequent bacterial resistance, which considers a significant global problem (Segura-Egea et al., 2017). Unfortunately, 10% of the antibiotics prescription among clinicians are those written by a dentist, which is found among many surveys in the UK and elsewhere (Thornhill et al., 2019). Also, Significant disparities have been discovered in research among clinicians regarding antibiotic dose and duration prescription for treating the same infection (Dar-Odeh et al., 2010; Lewis, 2008; Marra et al., 2016; Palmer et al., 2000). There has recently been a significant and rapid evolution of bacterial resistance to many common antibiotics, especially the broad-spectrum types, which are popular and over-prescribed because of the Antibiotics are being misused (Karki et al., 2011; Shapiro et al., 2014).

Recent findings in dentistry have indicated the identification of resistant bacteria from odontogenic deep neck infections, as well as primary and persisting infections (Al-Ahmad et al., 2014; Poeschl et al., 2011). Furthermore, horizontal transfer of bacterial-resistant genes across various bacterial species within the root canal has been documented (Sedgley et al., 2008). Lack of clinicians' Patient satisfaction, knowledge, and associated social factors are the main reasons dentists' inappropriate antibiotic prescribing habits (Cope et al., 2016; Oberoi et al., 2015). Eventually, regarding what was mentioned previously, it is essential to assess the antibiotic prescription by dentists to patients for endodontic infections and reduce their unnecessary consumption (Al-Haroni & Skaug, 2006). Al Khabuli et al., (2016) recently published research on dentists' knowledge and attitudes on prescription antibiotics in Emirates (UAE). They found that dentists had a reasonable awareness of antibiotic usage and misuse. Despite that, as long as we are aware, the criteria of prescribing antibiotics to manage infections of endodontic origin in the Qassim region have not been assessed. Therefore, the study tends to examine the prescriptions' attitude of the dentist towards antibiotics during endodontic treatment.

2. MATERIAL AND METHODS

This is a cross-sectional study was conducted in Saudi Arabia between September 2020 and October 2021. Depending on a systematic questionnaire completed by general dentists, endodontic specialists, and consultants in the province of Al-Qassim. The sample dimensions were calculated with a calculator Qualtrics of 95%, a sample size of 384.

Data collection and tool

Structured self-administrated questionnaires in English language were used as a study tool. Authors collected the information using social media channels through Google forms. The questionnaire includes demographic features such as (age, gender, Scope of practice and years of practice). However, the questions are about treatment of endodontic infection and Antibiotics prescription. The participants asked about Clinical situations.

Data analysis

The "Microsoft Office Excel Software" software for Windows was used to enter data on the computer. The data was then statistically evaluated using SPSS.

3. RESULTS

In table (1): of all studied 792 participants, 75.3% were males and 24.7% were females. 40.2% of studied sample aged between 20- 25 years old and 31.4% between 26- 30 years old. 37.4% live in Buraydah and 30.3% in Al Rass. 61.6% of participants were graduated after 2015 and 19.4% were graduated between 2010- 2015. Regarding experience, 69.6% have experience between 0- 5 years, 17.6% between 6- 10 years and only 6.8% more than 16 years of experience. 37.5% of participants were GDP, 18.3% endodontics, 17% dental intern and 18.1% were students.

Table 1 Sociodemographic characteristics of participants (n=792)

Parameter		No.	Percent
Gender	Male	596	75.3
	Female	196	24.7
Age	20-25	318	40.2
	26-30	249	31.4
	31-35	147	18.6

	More than 35	78	9.8
	Al Badayea	32	4.0
	Al bukayriyah	47	5.9
	Al Mithnab	8	1.0
Residence	Ar Rass	240	30.3
	Buraydah	296	37.4
	Unyazah	122	15.4
	Others	47	5.9
	Before 1990	30	3.8
	1990-2000	48	6.1
Year of graduation	2000-2010	72	9.1
	2010-2015	154	19.4
	After 2015	488	61.6
	0-5 years	551	69.6
	6-10 years	139	17.6
Years of practice	11-15 years	48	6.1
	16+ years	54	6.8
	Dental Intern	135	17.0
	Endodontic	145	18.3
	GDP	297	37.5
Scope of practice	Oral surgeon	24	3.0
	Periodontics	8	1.0
	Prosthodontist	16	2.0
	Restorative	24	3.0
	Student	143	18.1
	Academics	237	29.9
	Government service	211	26.6
	Military Hospitals	24	3.0
Working situation	Private practice (PP)	273	34.5
	Private Practice + Academics	47	5.9

Table 2 and figure 1 shows that 48.5% of participants prescribe antibiotics once a month, 17.8% twice a week, 14.8% once a week and 14% once in two weeks. Regarding situations in which participants would prescribe antibiotics, 2% prescribe for irreversible Pulpitis, 20.4% for mod/severe pre-op symptoms, 13.3% for necrotic pulp with symptomatic apical periodontitis, 17.3% for necrotic pulp with chronic apical abscess when sinus tract present and 1.6% for necrotic Pulp. 54.2% of participants prescribe a loading dose.

Table 2 Participants' attitude towards antibiotic prescription in endodontic treatment (n=792)

Parameter	No.	Percent
Times in a week prescribe antibiotics	More than three times in a week	16 2.0
	Once a month	384 48.5
	Once a week	117 14.8
	Once in 2 weeks	111 14.0
	Thrice a week	23 2.9
	Twice a week	141 17.8
	More than three times in a week	16 2.0

Situations you would prescribe antibiotics	Irreversible Pulpitis	80	2.0
	mod/severe pre-op symptoms	784	20.4
	Necrotic Pulp with Symptomatic Apical Periodontitis	48	1.2
	no swelling	112	2.9
	Necrotic Pulp with Chronic Apical Abscess	512	13.3
	sinus tract present		
	Necrotic Pulp with acute apical Abscess	664	17.3
	swelling Present		
	with symptomatic apical periodontitis	120	3.1
	no/mild pre-op symptoms	272	7.0
Situations need to prescribe antibiotics	Necrotic Pulp	64	1.6
	Incision & Drainage of a localized intraoral swelling	134	5.3
	no external swelling	331	13.3
	Post-op pain after instrumentation or obturation	40	1.6
	Endodontic surgeries (before or after)	497	20.0
	Incision & Drainage of a diffuse intraoral oral swelling + external swelling present	704	28.3
	Incision & Drainage of a diffuse intraoral swelling	277	11.16
	Perforation repair (before or after)	40	1.6
	Avulsion	459	18.4
Prescribe a loading dose	Yes	429	54.2
	No	363	45.8

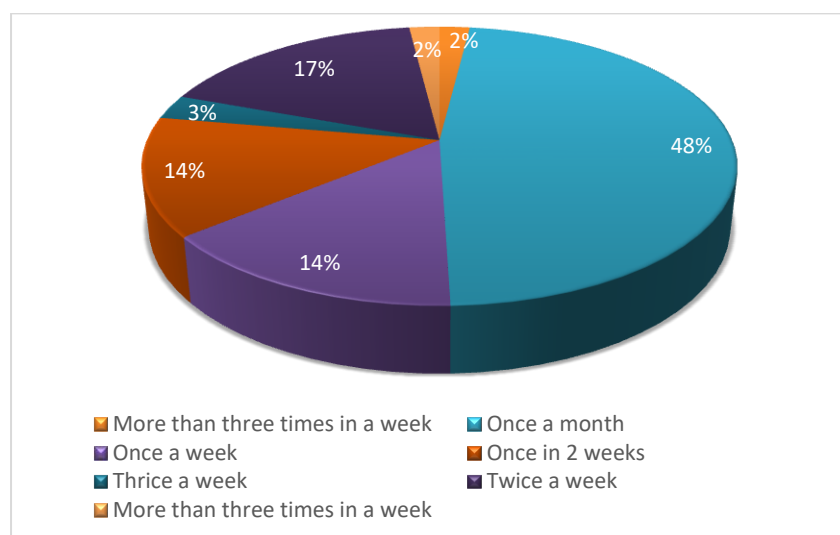


Figure 1 Times in a week prescribe antibiotics

Regarding antibiotic dosing in table 3 and figure 2; Amoxicillin dose prescribed for adults with no allergy was reported to be 500 mg by 66.2% of participants. Amoxicillin + clavulanic acid dose prescribed for adults with no allergy was reported 500mg by 66.3%.

Table 3 Antibiotic dosing for adult male with or without allergy (n=792)

Parameter		No.	Percent
Amoxicillin dose prescribed for adults with no allergy	1 g	8	1.3
	150 mg	32	5.2
	250 mg	71	11.5
	300 mg	48	7.8
	375 mg	24	3.9
	500 mg	407	66.2
	600 mg	16	2.6
	625 mg	8	1.3
Amoxicillin + clavulanic acid (Augmentin) dose prescribed for adults with no allergy	1 g	8	1.3
	150 mg	32	5.2
	250 mg	71	11.6
	300 mg	48	7.8
	375 mg	24	3.9
	500 mg	407	66.3
	600 mg	16	2.6
	625 mg	8	1.3
Clindamycin dose prescribed for adults with no allergy	1 g	8	1.0
	150 mg	16	1.9
	250 mg	7	0.8
	300 mg	39	4.7
	375 mg	0	0.0
	500 mg	8	1.0
	600 mg	8	1.0
	625 mg	0	0.0
Azithromycin dose prescribed for adults with no allergy	1 g	8	1.0
	150 mg	0	0.0
	250 mg	7	0.8
	300 mg	0	0.0
	375 mg	0	0.0
	500 mg	24	2.9
	600 mg	0	0.0
	625 mg	0	0.0
Metronidazole dose prescribed for adults with no allergy	1 g	8	1.0
	150 mg	0	0.0
	250 mg	23	2.8
	300 mg	16	1.9
	375 mg	0	0.0
	500 mg	130	15.7
	600 mg	0	0.0
	625 mg	0	0.0
Antibiotic dose prescribed for adults with no allergy	1 g	0	0.0
	150 mg	0	0.0
	250 mg	0	0.0

	300 mg	0	0.0
	375 mg	0	0.0
	500 mg	0	0.0
	600 mg	0	0.0
	625 mg	7	1.0
Clindamycin dose for adult patient with penicillin allergy	1 g	0	0.0
	150 mg	48	5.8
	250 mg	40	4.8
	300 mg	285	34.3
	375 mg	32	3.9
	500 mg	102	12.3
	600 mg	48	5.8
	625 mg	16	1.9
Azithromycin dose for adult patient with penicillin allergy	1 g	8	1.0
	150 mg	0	0.0
	250 mg	15	1.8
	300 mg	23	2.8
	375 mg	0	0.0
	500 mg	40	4.8
	600 mg	40	4.8
	625 mg	0	0.0
Metronidazole dose for adult patient with penicillin allergy	1 g	8	1.0
	150 mg	0	0.0
	250 mg	16	1.9
	300 mg	24	2.9
	375 mg	8	1.0
	500 mg	338	40.7
	600 mg	0	0.0
	625 mg	0	0.0
Erythromycin dose for adult patient with penicillin allergy	1 g	8	1.0
	150 mg	8	1.0
	250 mg	15	1.8
	300 mg	8	1.0
	375 mg	8	1.0
	500 mg	16	1.9
	600 mg	0	0.0
	625 mg	0	0.0
Lincomycin dose for adult patient with penicillin allergy	1 g	8	1.0
	150 mg	0	0.0
	250 mg	0	0.0
	300 mg	8	1.0
	375 mg	0	0.0
	500 mg	0	0.0
	600 mg	0	0.0
	625 mg	0	0.0
Antibiotic dose for adult patient with penicillin allergy (other than mentioned)	1 g	0	0.0
	150 mg	0	0.0
	250 mg	8	1.0
	300 mg	8	1.0

375 mg	0	0.0
500 mg	8	1.0
600 mg	0	0.0
625 mg	0	0.0

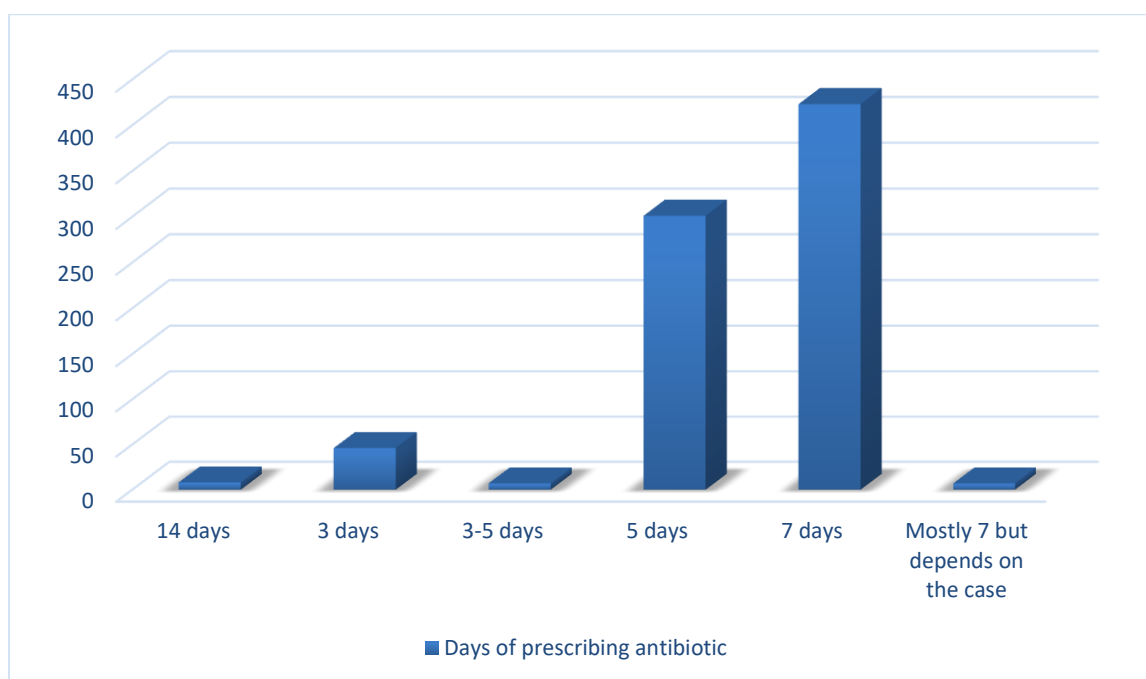


Figure 2 Days of prescribing antibiotic by participants

Table 4 shows that almost half participants 53.4% prescribe the antibiotic for 7 days and 38% for five days. 42.7% of participants change the antibiotic if antibiotic prescription is ineffective after 2-3 days and 33.2% add another antibiotic. 52.2% follow AAE guidelines for antibiotic use while 43.4% follow the Saudi Ministry of Health (MOH). Table (5) illustrate that, there was high significant association between times in a week prescribe antibiotics with age, gender, years of practice, scope of practice and working situation ($P= 0.001$)

Table 4 Participant's length prescription of antibiotics and alternative options if antibiotic prescription is ineffective (n=792)

Parameter		No.	Percent
Days of prescribing antibiotic	14 days	8	1.0
	3 days	46	5.8
	3-5 days	7	.9
	5 days	301	38.0
	7 days	423	53.4
	Mostly 7 but depends on the case	7	.9
If antibiotic prescription is ineffective after 2-3 days, what would to do	Add a second antibiotic	263	33.2
	Change antibiotics	338	42.7
	Extend the duration of the current antibiotic	191	24.1
If decide to change antibiotic, to which antibiotic	Clindamycin	40	17.5
	Change amoxicillin to Augmentin	8	3.5
	Metronidazole	32	14.0
	Augmentin	40	17.5

	Amoxicillin	8	3.5
	Combination	7	3.1
	Azithromycin	8	3.5
	Klavox 500mg	8	3.5
	choice based on culture	7	3.1
	Take culture	16	7.0
	refer to Endodontist	16	7.0
	Take a culture	8	3.5
	Ciprofloxacin	7	3.1
	Amoxy clox	8	3.5
	Metr 500 mg	8	3.5
	Amoxi 1 g	8	3.5
Prescribe antibiotics to patients if you are not accessible due to an upcoming weekend/holiday	Yes	103	13.0
	No	689	87.0
Guidelines for antibiotic use at practice/hospital/university	Yes	720	90.9
	No	72	9.1
Guidelines followed for prescribing antibiotics	Saudi Ministry of Health (MOH)	528	43.4
	AAE	635	52.2
	British Endodontic Society (BES)	32	2.6
	European Society of Endodontology (ESE)	22	1.8

Table 5 Association between antibiotic prescription with sociodemographic characteristics and years of experience of participants (n=792)

		Times in a week prescribe antibiotics						Total (N=792)	P value
		Once a month	Once in 2 weeks	Once a week	Twice a week	Thrice a week	More than three times in a week		
Age	20-25	278	79	101	77	8	8	551	0.001
		72.4%	71.2%	86.3%	54.6%	34.8%	50.0%	69.6%	
	26-30	24	8	0	16	0	0	48	
		6.3%	7.2%	0.0%	11.3%	0.0%	0.0%	6.1%	
	31-35	7	16	0	8	15	8	54	
		1.8%	14.4%	0.0%	5.7%	65.2%	50.0%	6.8%	
	More than 35	75	8	16	40	0	0	139	
		19.5%	7.2%	13.7%	28.4%	0.0%	0.0%	17.6%	
Gender	Male	283	104	85	93	23	8	596	0.001
		73.7%	93.7%	72.6%	66.0%	100.0%	50.0%	75.3%	
	Female	101	7	32	48	0	8	196	
		26.3%	6.3%	27.4%	34.0%	0.0%	50.0%	24.7%	
Residency	Al Badayea	8	0	0	16	0	8	32	0.001

		2.1%	0.0%	0.0%	11.3%	0.0%	50.0%	4.0%	
	al buhayriyah	16	0	0	23	8	0	47	
		4.2%	0.0%	0.0%	16.3%	34.8%	0.0%	5.9%	
	Al Mithnab	0	0	8	0	0	0	8	
		0.0%	0.0%	6.8%	0.0%	0.0%	0.0%	1.0%	
	Ar Rass	144	32	16	40	8	0	240	
		37.5%	28.8%	13.7%	28.4%	34.8%	0.0%	30.3%	
	Buraydah	109	48	62	62	7	8	296	
		28.4%	43.2%	53.0%	44.0%	30.4%	50.0%	37.4%	
	Others	39	8	0	0	0	0	47	
		10.2%	7.2%	0.0%	0.0%	0.0%	0.0%	5.9%	
	Unyazah	68	23	31	0	0	0	122	
		17.7%	20.7%	26.5%	0.0%	0.0%	0.0%	15.4%	
Years of practice	0-5 years	278	79	101	77	8	8	551	0.001
		72.4%	71.2%	86.3%	54.6%	34.8%	50.0%	69.6%	
	6-10 years	75	8	16	40	0	0	139	
		19.5%	7.2%	13.7%	28.4%	0.0%	0.0%	17.6%	
	11-15 years	24	8	0	16	0	0	48	
		6.3%	7.2%	0.0%	11.3%	0.0%	0.0%	6.1%	
	16+ years	7	16	0	8	15	8	54	
		1.8%	14.4%	0.0%	5.7%	65.2%	50.0%	6.8%	
	Dental Intern	72	31	16	16	0	0	135	
		18.8%	27.9%	13.7%	11.3%	0.0%	0.0%	17.0%	
Scope of practice	Endodontic	98	8	0	32	7	0	145	0.001
		25.5%	7.2%	0.0%	22.7%	30.4%	0.0%	18.3%	
	GDP	63	48	93	77	0	16	297	
		16.4%	43.2%	79.5%	54.6%	0.0%	100.0%	37.5%	
	Oral surgeon	0	0	8	8	8	0	24	
		0.0%	0.0%	6.8%	5.7%	34.8%	0.0%	3.0%	
	Periodontics	0	8	0	0	0	0	8	
		0.0%	7.2%	0.0%	0.0%	0.0%	0.0%	1.0%	
	Prosthodontist	0	8	0	0	8	0	16	
		0.0%	7.2%	0.0%	0.0%	34.8%	0.0%	2.0%	
	Restorative	16	0	0	8	0	0	24	
		4.2%	0.0%	0.0%	5.7%	0.0%	0.0%	3.0%	
	Student	135	8	0	0	0	0	143	
		35.2%	7.2%	0.0%	0.0%	0.0%	0.0%	18.1%	

Working situation	Academics	166	48	0	0	15	8	237	0.001
		43.2%	43.2%	0.0%	0.0%	65.2%	50.0%	29.9%	
	Government service	132	15	8	56	0	0	211	
		34.4%	13.5%	6.8%	39.7%	0.0%	0.0%	26.6%	
	Military Hospitals	16	0	8	0	0	0	24	
		4.2%	0.0%	6.8%	0.0%	0.0%	0.0%	3.0%	
	Private practice (PP)	39	48	93	77	8	8	273	
		10.2%	43.2%	79.5%	54.6%	34.8%	50.0%	34.5%	
	Private Practice + Academics	31	0	8	8	0	0	47	
		8.1%	0.0%	6.8%	5.7%	0.0%	0.0%	5.9%	

4. DISCUSSION

Endodontic infections are polymicrobial in nature, encompassing facultative anaerobes Gram-negative and Gram-positive as well as purely anaerobic bacteria. Antibiotics can thus be administered in combination with endodontic therapy (Juan José Segura-Egea et al., 2017). The best current clinical data somehow doesn't advocate the use of antibiotics unless they are absolutely necessary, as the infection is systemic, patient is feverish, or both. As a result, in situations with necrotic pulp with acute or chronic apical periodontitis, no edema, and moderate/severe symptoms, antibiotics should be avoided. Endodontic treatment, including debridement of the root-canal space and analgesics, should be reserved for these cases. Typically, a correct diagnosis combined with effective root-canal treatment will be enough to reduce the microbial load and allow healing (Aminoshariae & Kulild, 2016).

In our study, 2% of participants prescribe antibiotics for irreversible Pulpitis, 20.4% for mod/severe pre-op symptoms, 13.3% for necrotic pulp with symptomatic apical periodontitis, 17.3% for necrotic pulp with chronic apical abscess when sinus tract present and 1.6% for necrotic Pulp. 54.2% of participants prescribe a loading dose. Dornet et al., (1977) conducted several surveys to investigate the antibiotics using for endodontic infections by American Board of Endodontists diplomates. One of most typical causes of prescription antibiotics were edema and a lack of drainage via the canal, with necrotic pulp getting the largest percentage of medicines (87.6%) (Sivaraman et al., 2013). Kumar et al., (2013) investigated antibiotic prescription practices in the treatment of pulpal and PA disease and 68.5 percent of dentists administered antibiotics for endodontic treatment, according to the study. Antibiotics were most frequently prescribed for acute apical periodontitis, edema, and pulp necrosis with moderate/severe preoperative symptoms (92.1%).

In a study of British general dental practitioners who provided NHS treatment, antibiotics were administered by greater than 95 percent of dentists to prevent infections from spreading, antibiotics were administered by 12.5% of dentists for acute pulpitis, either before (69%) or after (23%) the draining of acute abscesses (Palmer et al., 2000). The antibiotic prescription trends of Yemeni general dentists were investigated in research. Antibiotic misuse was shown to be more common: Acute apical periodontitis without edema was seen in 32% of individuals with pulpitis 66.3 percent, 84 percent of dentists recommended an antibiotic without a clinical justification (72 percent) (Al-Haroni & Skaug, 2006). In a subsequent research, According to Tulip and Palmer, (2008) 39% of dentists suggest antibiotics for pulpitis, 44.4 percent for apical periodontitis, 68.8% for apical periodontitis with little swelling, and 84.8 percent for acute apical abscess. Antibiotics were administered for symptomatic apical periodontitis by more than 60% of Lithuanian dentists. Antibiotics had been administered for symptomatic pulpitis by around 2% of those questioned (Skučaitė et al., 2010).

In a study of antibiotic prescriptions in dental emergencies, Dailey and Martin, (2001) discovered that antibiotics were prescribed incorrectly in 75% of cases. Antibiotic prescription in Belgian dental clinics was researched by Mainjot et al., (2009) antibiotic prescriptions were allocated in the following ways: for periapical abscess 63.3 percent and in the absence of fever (92.2%), without any local therapy (54.2%), and for pulpitis (92.2%)(4.3 percent)(Kaptan et al., 2013). For the treatment of endodontic infections in most countries, amoxicillin is the first-line antibiotic of choice (Aminoshariae & Kulild, 2016; Segura-Egea et al., 2010). Another American study indicated that only 28% of endodontists prescribed amoxicillin (Yingling et al., 2002). Erythromycin (Whitten et al., 1996) and clindamycin (Yingling et al., 2002) were prescribed inpatients allergic to penicillin. A study reported that the chosen antibiotic was amoxicillin, according to dentist for Root canal infections (Nabavizadeh et al., 2011). Amoxicillin is the

primary antibiotic of choice in India for people with no medical allergies, followed by oxoflacyn/ornidazole, then erythromycin for patients allergic to penicillin (Garg et al., 2014; Jayadev et al., 2014).

In Saudi Arabia, according to a research, the medicine of choice was amoxicillin, Clindamycin was the first line of therapy for allergic people, whether given alone or in combination with clavulanic acid or metronidazole (Iqbal, 2015). Another study found correlation between the duration of professional activity and pre-prescription of antibiotics (Skučaitė et al., 2010).

5. CONCLUSION

In summary, Saudi Endodontists and Dentists' antibiotic prescribing practices are consistent with international standards. There were, however, instances of unsuitable prescriptions, like in patients with irreversible pulpitis, necrotic pulps with no systemic involvement, and/or sinus tracts. Antibiotics and their indications in endodontics must be better understood by Endodontists and Dentists.

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Consent

Informed consent was obtained from all participants included in the study

Ethical approval

The research proposal was approved by the Regional Research and Ethics committee of Qassim University with Ethical approval number (2021-32).

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The study did not receive any external funding

Conflict of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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