



The Review Of Antibiotics During Course Of Endodontic Treatment By Dentists In India: A Comprehensive Survey

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Abstract

Background: To investigate prescribing of antibiotics practices for various endodontic diagnoses and clinical scenarios by general practitioners, post-graduate students and endodontists in India.

Materials & methods: A link for an online questionnaire consisting of two parts; the first part includes demographic information like name, age, designation of endodontic practice; the second part contains the questions related to decision about antibiotic while treating endodontic infections was invited to dentists through google form. After collection of the responses, a chi-square test was performed using SPSS v21.0 software.

Results: A total of 548 responses were obtained from 2462 dentists. The majority of the participants were general dental practitioners (GDP, 67%) while 3% were Endodontists. Gender,

age and speciality were significant risk factors for antibiotic prescription. GDPs prescribed antibiotics twice as much as all specialist. Amoxicillin with clavulanic acid was the most prescribed antibiotic (87.4%), followed by Penicillin (6%). Erythromycin was the drug of choice for the patients with penicillin allergy (47.6 %). The most common reasons for antibiotic prescriptions for all of reasons like to control spread of infection, prophylaxis and to avoid pain and swelling followed by to control spread of infection. Completing a course of prescribed antibiotics was recommended by most participant. Up to 44.7 % of participants prescribed antibiotics for reversible pulpitis.

Conclusion: The majority of dentists reported they prescribed antibiotics inappropriately. It is necessary to improve the knowledge of dentists about antibiotics and their indications in endodontics.

Keywords: antibiotics, bacterial infection, endodontics

INTRODUCTION

The spectrum of antibiotic pathosis includes many conditions for which dentists and endodontists determine that it is appropriate to prescribe antibiotics.¹ Antimicrobial resistance is the ability of a microorganism to withstand the effect of antibiotics, which may occur due to certain bacterial species developing resistance to antibacterial agents shortly after they are used.^{1,2} However, to maximize benefits they should be used rationally by considering drug interaction, side effects and in order to prevent bacterial resistance.³ The genetic changes of drug resistant bacterial strains have been linked to excessive prescribing of antibiotics including for endodontic infection.⁴⁻⁶ Considering that dentists prescribe 13.2% of all commonly used antibiotics, they have a remarkable impact on global antibiotic resistance.⁷

In endodontics, it is recommended that antibiotics should be used only as an adjunct to definitive nonsurgical or surgical endodontic therapy.⁸ Acute apical abscess with systemic involvement such as fever, lymphadenopathy, trismus or facial cellulitis are typically endodontic cases that require antibiotics because of the possible risks of spread via lymph or blood circulations.⁹ But pain arising from symptomatic irreversible pulpitis, symptomatic apical periodontitis or localized acute apical abscess without systemic can be treated by a complete chemo-mechanical

debridement, proper pain control, medication and incision for drainage if necessary but without antibiotics.¹⁰⁻¹² Numerous studies conducted in different countries revealed that prophylactic or therapeutic antibiotic prescribing patterns of dentists are frequently improper.^{1,13-17}

The prescriber's knowledge and expectations of the patients have a direct link to antibiotic prescribing patterns.¹⁸ During survey analysis to evaluate antibiotic prescribing patterns, the presentation of the clinical cases can provide more evidence from misuse of the antibiotics and would be guidance for dentists to reduce the prescription of the antibiotics.

In this survey, the aim was to investigate antibiotic prescribing patterns related to endodontic treatment by endodontists in India.

MATERIALS AND METHODS

To obtain data necessary for meeting the study objective, an online questionnaire was developed and was made available to Indian dentists via the following link https://docs.google.com/forms/d/e/1FAIpQLSeX6DO7uww3U0OhFoNbKvwLEyf3n_djATLYZafiKpNy4w4oNQ/viewform?usp=sf_link composing two sections was prepared. The link was made sent to Indian dentists through e-mail and social network. Only dentists whose email addresses were publicly available on the internet and others through social network were contacted and invited to take part in the survey. This resulted in an initial sample of 2462 respondents. The survey were adapted from previously published questionnaires (*Mainjot et al. 2009, Deniz-Sungur et al. 2010 & Kumar et al. 2013*).

The questionnaire commenced with a demographic information of the participants such as name, age and specialty and 10 questions about general treatment approaches of the participants such as, frequency of endodontic treatment and antibiotic prescription, frequently prescribed antibiotics in routine cases or in case of allergy, reasons for prescription, duration of antibiotic therapy, approaches for prophylaxis, records of prescribed antibiotics and awareness of antibiotic resistance. The questions were formulated with possible answer options and the respondents were invited to choose the answer that best affirmed their clinical attitude by indicating only one category.

To develop the questionnaire, a Google forms free online survey was utilized as it facilitated direct input of the survey data into a spreadsheet, thus aiding in subsequent analyses. After

collection of the responses, all the questionnaires answered were included in the analysis. The likelihood ratio chi-square test was implemented to test whether there is a significant improvement in the fitted model. The level of significance was set as $p < 0.05$. Statistical analysis were performed using SPSS version 21 Software (SPSS Inc. Chicago, IL, USA).

RESULTS

Sample size determination

The link was made sent to all 2462 Indian dentists practicing in India through e-mail and social media. Only dentist whose email addresses were publicly available, resulting in 548 (22.26%) respondents.

Demographics of the participants

The demographics of the participants are illustrated in Figure 1. The sample comprised of 3.3% Endodontists, 67.3% General dentists, 5.5% Other specialists, 23.9% Post graduate students. Aged 25- 34 years were maximum respondents (80.7%), While those aged 45-54 were less represented (0.5%).

Table 1: The demographics of the participants

Designation	Frequency	Percentage
endodontists	18	3.3
General dentists	369	67.3
Other specialist	30	5.5
postgraduate	131	23.9

total	548	100
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Age	Frequency	Percentage
Below 25	45	8.2
25-34	442	80.7
35-44	52	9.5
45-54	3	0.5
Above 55	6	1.1
Total	548	100.0

General antibiotic prescribing patterns of the participants

The percentage of general prescribing patterns of the participants are demonstrated in Table 2.

According to collected data, the common reasons for antibiotic prescription were, to control spread of infection and reduce fever (52.3%), to avoid swelling and pain (38.8%), to manage psychology and reduce patient's anxiety (5.47%), Prophylaxis (3.3%). So there were a statistical difference ($p \leq 0.05$). The majority of participants (90.1%) recommended oral antibiotics. Most of representatives (56.7%) prescribed 5 days course of antibiotic therapy and 31.8% of them recommended 3 days of antibiotic course. Amoxicillin + Clavulanic acid was the most prescribed antibiotic (87.4%) followed by penicillin (6.0%). Erythromycin (47.5) was the first and Ciprofloxacin (31.8) were second most preferred antibiotic in case of penicillin allergy. The majority (95%) asked their patients whether they used antibiotic during treatment. Most of the participants (87.9%) informed patients about the results of improper use of antibiotics. 76.4 % of dentists prescribed antibiotic for symptomatic irreversible pulpitis, pulp necrosis, symptomatic apical periodontitis. The findings showed that overall antibiotic prescription levels were 54.9%, 17.15%, 3.7%, 0.7% for General dentists, Post graduate students, other specialist and Endodontists, respectively. Most of the participants (98.9%) take medical history before prescribing antibiotics. Most of the dentists (84.6%) prescribed antibiotics without clinical evidence of bacterial infection.

Table 2: General antibiotic prescribing patterns of the participants

Sr.no	Question	Options	Frequency	Percentage
1	Reason for prescription of antibiotics	To manage psychology and reduce patient's anxiety	30	5.47
		Prophylaxis	18	3.3
		To avoid swelling and pain	213	38.8
		To control spread of infection and reduce fever	287	52.3
2	Recommended route of administration of antibiotics during course of endodontic treatment	Intramuscular	3	.5
		Intravenous	30	5.5
		Oral	494	90.1
		Sublingual	21	3.8
3	Duration of antibiotic prescription	1 week	57	10.4
		3 days	174	31.8
		5 days	311	56.7
		Don't prescribed	6	1.1
4	The most frequently preferred antibiotics	Amoxicillin + Clavulanic acid	479	87.4
		Clindamycin	9	1.6
		Macrolides	3	0.5
		Ofloxacin	24	4.4
		Penicillin	33	6.0
5	If patient is allergic to penicillin, the most prescribed antibiotics?	Cephalosporins	92	16.7
		Ciprofloxacin	174	31.8
		Clarithromycin	21	3.8
		Erythromycin	261	47.6
6	Do you enquire from patient about he/she	All of the above	3	0.5

	has taken antibiotic during treatment?	No	12	2.2
		Undecided	12	2.2
		Yes	521	95.0
7	Do you inform patients about the results of improper usage of antibiotics before prescribing?	No	27	4.9
		Undecided	39	7.1
		Yes	482	87.9
8	Do you prescribed antibiotics for symptomatic irreversible pulpitis, pulp necrosis, symptomatic apical periodontitis?	No	42	7.6
		Undecided	87	15.8
		Yes	419	76.4
9	Do you take medical history of the patient before prescribing antibiotics?	No	6	1.1
		Yes	542	98.9
10	Do you start antibiotics without clinical evidence of bacterial infection?	No	464	84.6
		Undecided	36	6.6
		Yes	48	8.8

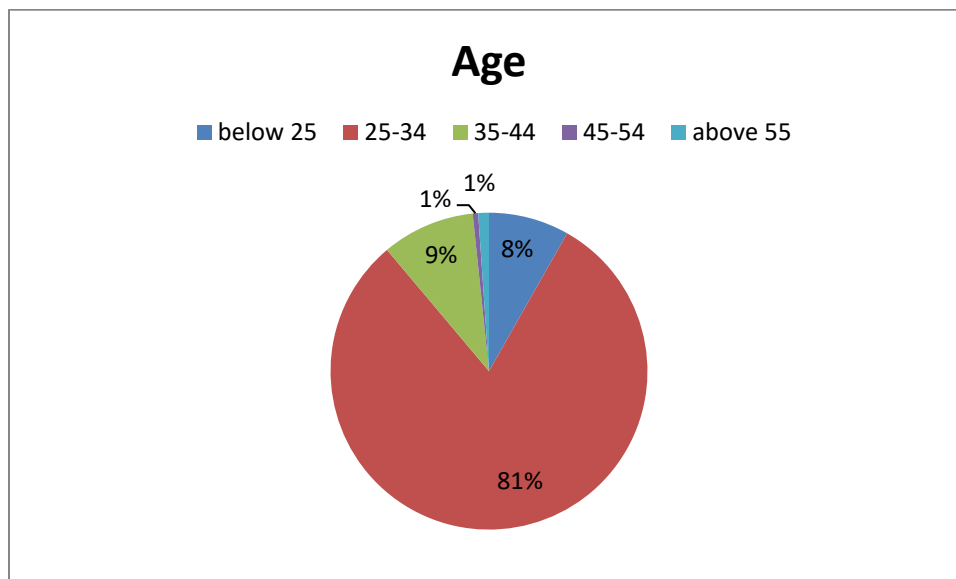
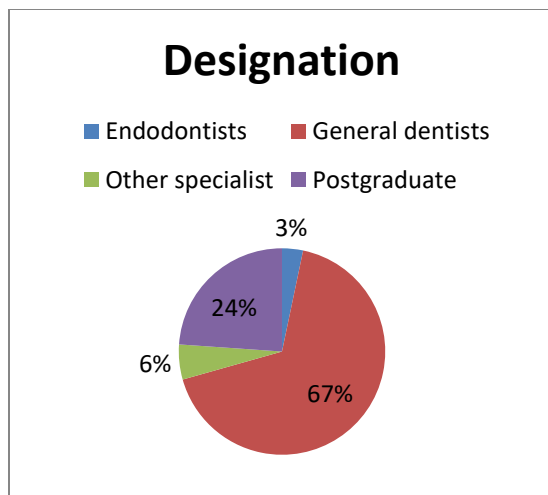
Sr. no	Question	options	Endodontists	General dentists	Other specialists	Post graduate	P value
1	Reason for prescription of antibiotics	To manage psychology and reduce patient's anxiety	0	27	00	03	0.001
		Prophylaxis	0	15	0	03	
		To avoid swelling and pain	6	127	20	60	
		To control spread of infection	12	200	10	65	
2	Recommended route of administration of	Intramuscular	0	3	0	3	0.000
		Intravenous	0	30	0	0	

	antibiotics during course of endodontic treatment	Oral	18	315	30	128	
		Sublingual	0	21	0	0	
3	Duration of antibiotic prescription	1 week	0	45	3	9	0.000
		3 days	12	90	18	54	
		5 days	6	225	9	68	
		Don't prescribed	0	9	0	0	
4	The most frequently preferred antibiotics	Amoxicillin + Clavulanic acid	15	321	30	113	0.000
		Clindamycin	0	9	0	0	
		Macrolides	0	3	0	0	
		Ofloxacin	3	9	0	12	
		Penicillin	0	27	0	6	
5	If patient is allergic to penicillin, the most prescribed antibiotics?	Cephalosporins	6	54	6	26	0.000
		Ciprofloxacin	0	120	12	42	
		Clarithromycin	0	9	3	9	
		Erythromycin	12	168	9	54	
6	Do you enquire from patient about he/she has taken antibiotic during treatment?	All of the above	0	6	0	0	0.000
		No	3	6	3	0	
		Undecided	0	12	0	0	
		Yes	15	345	27	131	
7	Do you inform patients about the results of improper usage of antibiotics before prescribing?	No	3	18	0	6	0.000
		Undecided	0	24	0	15	
		Yes	15	321	30	110	

8	Do you prescribed antibiotics for symptomatic irreversible pulpitis, pulp necrosis, symptomatic apical periodontitis?	No	14	02	10	16	0.001*
		Undecided	0	66	0	21	
		Yes	04	301	20	94	
9	Do you take medical history of the patient before prescribing antibiotics?	No	0	3	0	0	0.933
		Yes	18	363	30	131	
10	Do you start antibiotics without clinical evidence of bacterial infection?	No	15	303	27	116	<0.01*
		Undecided	0	24	0	12	
		Yes	3	39	3	3	

*Statistically significant at $p < 0.05$

Figure 1: Illustrations of demographics of the participants



DISCUSSION

The present observational study based in questionnaires responded by 548 Indian dentists investigated the habits of dentists from India in prescribing antibiotics. An on-line questionnaire survey was adapted from previously published questionnaires.¹⁹⁻²¹ Unfortunately, despite sending two- reminders, a greater response rate could not be achieved.

Although this is one of the few reports regarding antibiotic prescribing pattern in the treatment of endodontic infections, there is are important limitations of this type of study; as with all the questionnaire- based surveys, there is the risk in relation to the consistency of responses and the

problem of nonresponse bias. Thus, caution must be applied in interpreting the results, as there is the potential for those who prescribe antibiotics differently to have not responded (nonresponder bias).

Some nonclinical factors like to manage psychology and reduce patient's demand may affect antibiotic prescription patterns as well.¹⁰ The most common reasons for antibiotic prescription in this survey were to control spread of infection and fever (52.3%), To avoid swelling and pain (38.8%), To manage psychology and reduce patient's anxiety (5.47%), prophylaxis (3.3%). Relatively high rates of prescription of antibiotics for preventing swelling and pain (38.8%) may also be assumed as a reflection of concerns about satisfying patients and losing referrals compelled dentists to prescribe unnecessary antibiotics. However, informing the patient about possible post-operative risks of infection and prescribing a "stand-by" antibiotic after a proper endodontic intervention is more logical.²³

It has also been shown that more than 80% of dental prophylactic antibiotic prescriptions in the US were unnecessary.²⁴ For this reason, prophylaxis is only recommended for patients in the high-risk categories such as previous infective endocarditis and artificial or repaired heart valves but not any more for the patients with mitral valve prolapse, even with severe regurgitation.²⁵ Guidelines emphasize the individual basis of prophylaxis after consultation with the patients and/or their medical doctors. Interestingly, frequency of antibiotic prescription of dentists to manage psychology and reduce patient's anxiety (5.47%), prophylaxis (3.3%) were lower.

Jayadev et al.²⁵ studied the pattern of antibiotic prescription for pulpal and periapical pathologies among Indian dentists. Of the respondents to the survey, 44% stated that they would prescribe medication for elevated body temperatures and evidence of system involvement, while 42.8% would prescribe medication for non-clinical factors, such as unsure diagnosis.

In this present survey 56.7% and 31.8% prescribed antibiotics for 5 days and 3 days respectively. But the recommended dose regimen for amoxicillin is 500 mg three times a day (with or without a loading dose of 1000 mg) for adults. Most practitioners usually prescribe antibiotics in courses of 3 to 7 days. Interestingly, some evidence suggests that perhaps shorter courses (2-3 days) may be successfully used as adjuvant therapies. The decision of using antibiotics for longer periods (7

to 10) is largely based on studies and clinical practice of treating infections whose etiology is not fully identified or the treatment of bloodstream infections in hospitalized patients.

Amoxicillin + Clavulanic acid was the most prescribed antibiotic (87.4%) in this survey followed by ofloxacin (4.4%). In cases of penicillin allergy, Erythromycin (47.6%) and Ciprofloxacin (31.8%) were the most preferred antibiotics. Amoxicillin with clavulanic acid has been shown to be effective against 100% of cultivable endodontic bacteria, increasing the spectrum of amoxicillin in persistent infections and is characterized by a much broader spectrum of activity compared to penicillin and amoxicillin, it carries a higher risk of the development of bacterial resistance and there are potentially significant side effects that include gastrointestinal and hepatic disturbances.

Unluckily, a lack of knowledge concerning the names of this antibiotics among Indian dentists was noticed as well as reflected from this survey. Erythromycin is a macrolide antibiotic with a spectrum similar to penicillin in India and Iran which is in consistency with this present survey. Unfortunately, Kurimaya et al.²⁶ found that the *Fusobacterium* and *Prevotella* lineages from dentoalveolar infections were resistant to these antibiotics.

Majority of participants (95%) had enquired from patient about he/she has taken antibiotic during treatment and 87.9 % had informed patients about the results of improper usage of antibiotics before prescribing.

According to the American Association of Endodontists Position Statement 2017, ESE 2018,²⁷ antibiotics are indicated for asymptomatic apical abscess for medically compromised patients, localized asymptomatic apical abscess with systemic involvement, progressive infections such as cellulitis, soft tissue trauma requiring intervention and avulsion but not for symptomatic irreversible, pulp necrosis, symptomatic apical periodontitis or chronic apical abscess or localized acute abscess without systemic involvement.

In this survey 74.6% prescribed unnecessary antibiotics for symptomatic irreversible pulpitis, pulp necrosis, symptomatic apical periodontitis which led to one of the most causative factor for bacterial resistance. Asymptomatic cases of pulp necrosis with apical periodontitis associated with sinus tract should be treated by removal of the cause of the infection by non- surgical endodontic treatment, with the aid of intracanal medicament. In case of pulp necrosis and acute

apical periodontitis, with pain but without swelling, the recommended treatment for this situation is limited to non- surgical root canal treatment. In cases of endodontic abscess, without local signs of infected spread, after non-surgical endodontic treatment the host defenses should be able to control these infections. Therefore, the use of antibiotics in addition to analgesics for pain and local decontamination does not provide benefits to the patient. In irreversible pulpitis with acute apical periodontitis the pulp remains vital; there is no infection or signs and symptoms of systemic involvement, thus antibiotics are not indicated. According to Skucaite et al.²⁸ and Mainjot et al.¹⁹ the percentage of prescription were low for this situation in Lithuania and Belgium respectively, while this percentage was higher in studies carried out in Kuwait (19.6%), Iran (80.6%) and India (71.6%).²⁹⁻³¹ Kumar et al.³¹ determined the antibiotic prescribing habits for pulpal and peri- apical pathology among dentists in Hyderabad, India. The total percentage of dentists who prescribed antibiotics for endodontic management was 68.5%. The most common indication for antibiotics was a necrotic pulp with acute apical periodontitis with swelling and moderate/severe preoperative symptoms (92.1%).

In the treatment of endodontic infections, use of antibiotics is indicated in a small number of clinical situations, namely for acute apical abscesses in medically infections, and persistent infections. Thus antibiotics should only be used as adjuvant therapies in cases with evidence of systemic involvement (fever, malaise, cellulitis and/ or lymphadenopathies) following adequate endodontic disinfection and abscess drainage if swelling is present. In addition, patients who are immune-compromised or have predisposing conditions such as previous endocarditis should be medicated as a prophylactic measure. It is important to note that administration of antibiotics in the absence of the above – mentioned reasons has no evidence of therapeutic benefits. Moreover, therapies lasting 7 days with amoxicillin have been shown to increase the population of resistant strains.

98.9% took medical history of the patient before prescribing antibiotics. Most of the participants (84.6%) didn't start antibiotics without clinical evidence of bacterial infection and 8.8% prescribed antibiotics empirically by practitioners. Occasionally, despite adequate local debridement an antibiotic coverage, the treatment is ineffective and the patient's condition deteriorates. The patient may have unusual species of virulent bacteria, multidrug resistant bacteria and/ or fungal infection. He/she may also have immune deficiency, uncontrolled

diabetes, penicillin allergy and / or a history of *C. difficile* infection. In these situation, culture and sensitivity testing may assist the practitioner in selecting the appropriate antibiotic. It is generally recognised, however that most oral bacterial species are commensal organisms, that about half of them are not cultivable, and that the effectiveness of antibiotics is variable in polymicrobial infections. Therefore, this testing may only provide additional guidance to the practitioner, in conjunction with surgical debridement.

CONCLUSION

The misuse of antibiotics by Indian general practitioner's was investigated and, considerable improper prescriptions were revealed. In terms of proper prescription, it is necessary to improve dentist's knowledge about antibiotics and their indications in endodontic infections with current guidelines and chosen post-graduate education.

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