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The Antibiotic Prescription Trend of Dentists for Endodontic Treatment from a Region of Pakistan: An Online Survey.

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Abstract

Purpose: Globally the overuse of systemic antibiotics is now a serious concern for the health professionals. The increase in antimicrobial resistant bacteria because of this practice has made treatment of infections ever more difficult. In providing endodontic treatment it has been found that many dentists are either misusing or overusing systemic antibiotics. The objective of this study was to assess the antibiotic prescribing trends of dentists in a region of Pakistan and if any association could be made of such practices with the experience of the dentist.

Methodology: This cross sectional study was based on an on line questionnaire. A total of 150 invitation were sent by emails and social media groups like 'Whattsapp'. This estimation of respondents was made by calculating the total fresh graduates and clinical dental faculty of the three dental institute of the region. The online survey was designed on the checklist based on Checklist for Reporting Results of Internet E-surveys (CHERRIES). SPSS version 20 was used to analyze the data. Chi square test was used with p- value< 0-05.

Results: There was an 84% response rate on this online questionnaire. Most of the participants (71.5%) were aware of guidelines for antibiotic use. Only 12.30% participants as a whole had attended a seminar or workshop in the last one year on recent guidelines for antibiotic prescription. Of the total, 42.30% of the respondents were prescribing antibiotics to 2-3 patients on a daily basis. Majority of the respondents (63.84%) would prefer penicillin's as the first choice of antibiotic if needed. But 62.7% of the fresh graduates would advise systemic antibiotics in a case of endodontic flare up where there is no recommendation or justification. With 44.7% dental practitioners' prescribing antibiotics in the same scenario it was statistically significant (p=0.0480).

Recommendations: Globally, the overuse of antibiotics is a trend which is concerning, here in the region of Abbottabad, Pakistan this same trend is present. Dental health care providers must understand that prescription of systemic antibiotics when not recommended may lead to antimicrobial resistance, whereas non-prescription when necessary may have detrimental health consequences. So the practitioners' knowledge of guidelines is irrelevant as long as they are not practicing it. Hence the rationale for not practicing on the guidelines is what needs to be further investigated in future studies.

Keywords: *Antibiotics in Endodontics, Overuse of Antibiotics, Prescription by Dentist.*

1.0 Introduction

Antibiotics are crucial in the treatment and prevention of infections that are life-threatening. However, if drugs become ineffective as a result of antimicrobial resistant bacteria, it is not possible to treat infections. Antibiotic prescribing guidelines and antimicrobial stewardship initiatives emphasize the importance of reducing unnecessary antibiotic prescriptions and ensuring that antibiotics are given at the correct dose, for the right duration, and with the best spectrum of antimicrobial activity to kill pathogens while reducing the risk of bacterial drug resistance[1]. Antibiotics are commonly used to treat odontogenic infections, non-odontogenic infections, local infections, focal infections, and prophylaxis in dental procedures. Comprehensive recommendations have been devised to reduce the inappropriate antibiotic prescriptions. Approximately only 12% of dentists are effectively and correctly prescribing antibiotics, demonstrating the significance of knowledge of guidelines[2]. The major reasons contributing to the growth of antibiotic resistance which is insufficient and excessive use of antibiotics is a common finding in Pakistan just like the other developing countries [3, 4, 5, 6].

In endodontics the use of systemic antibiotics has been laid down by guidelines formulated by associations like the American Association of Endodontics (AAE) and National Institute for Health and Care Excellence (NICE)'. If dentists are up to date with these guidelines which are based on evidenced based practices. Then there can be significant reduction of unnecessary prescriptions of antibiotics by general practioners performing endodontic procedures[7, 8]. A very recent study in Spain has outlined that 100% of endodontists would give antibiotics for pulp necrosis with asymptomatic apical periodontitis, fistulous tract, and mild/symptomatic symptoms. Also antibiotics would be prescribed by 20% of endodontists in the case of pulp necrosis with symptomatic apical periodontitis and no swelling which is wrong practice as per guidlines[9].

With ever increasing trend of tooth restorative procedures like endodontics and the inclination of practicing dentists for antibiotics prescriptions[10, 11], it is important that an assessment of antibiotic prescriptions for endodontic treatment be made in this region. As per our knowledge no study from Pakistan has been reported on this topic. Hence the aim of this research was to assess the awareness and practice of general dental practitioners of Abbottabad, Pakistan in prescribing antibiotics for endodontic treatment. Also, if there was any difference between fresh graduates and experienced dental practitioners' in prescribing antibiotics.

2.0 Materials and Method

The survey was carried out with the permission of Rehmat Memorial Postgraduate Dental Hospital Ethical Committee Abbottabad, Pakistan (WMC/RMDTH/EC/2084). Because it was an online survey for dentists and only those who consented participated in the survey, the review committee waived the necessity for formal consent. Still the survey first page was designed so that only dentists willing to participate would go on to the next section of questionnaire. Two endodontists examined and validated the survey questionnaire for clarity and relevance. After that, using Google forms, an online edition of the questionnaire was produced. A total of 150 invitations with survey link in total were sent to Whattsapp group members and emails of faculty and house officers of three dental colleges in the region of Abbottabad. The link was kept active for a period of approximately 2 weeks i.e. 1st April 2022 to 15th April 2022.

2.1 Survey Design

The online survey was designed on the checklist based on Checklist for Reporting Results of Internet E-surveys (CHERRIES) [12] (Appendix). The research team (which included an academician/endodontist consultant and two general dentists with five years of experience) created the online survey questionnaire based on prior studies on the subject[13]. For validation, it was tested with two dentists as pilot and necessary adjustments made. The questionnaire was divided into three sections. Section/Page: 1"Participants' information sheet (PIS)" was the first page of the online survey questionnaire. It included all the information that the participants needed to know as regards to the study along with consent to participate. Section/Page: 2 "General questions" with 08 general questions related to the number of endodontic case, preferred antibiotic, and guidelines etc. Section/Page: 3"Clinical scenarios" had 07 questions on clinical cases with option to answer with only "yes" or "no" as an indication for antibiotic prescription . All the questions in section 3 were close ended. While response was must on all questions in all sections.

2.2 Data Processing and Analysis

For data processing and analysis, IBM's Statistical Package for Social Sciences (SPSS) Version 20.0 was utilized. For categorical variables, the frequency distribution was used to describe participant characteristics. The segregation of participants was done based on two categories: fresh graduates/house officers (HO) and general dental practioners with permanent licenses (DPL). The associations between the categories on various clinical situations, and antibiotic prescribing frequency were assessed using the Chi-square test ($p < 0.05$).

3.0 Results

From the total 150 invitations sent 130 responded (86.6% response). The invitations were calculated based on the approximation of practicing dental college faculty and the house officers in all the three dental institutes. From the 130 respondent 66.93% were dental practioners with permanent licenses (DPL) and 33.07% were fresh graduates doing 12 months house jobs (HO) at their respective institutes as shown in as figure 1.

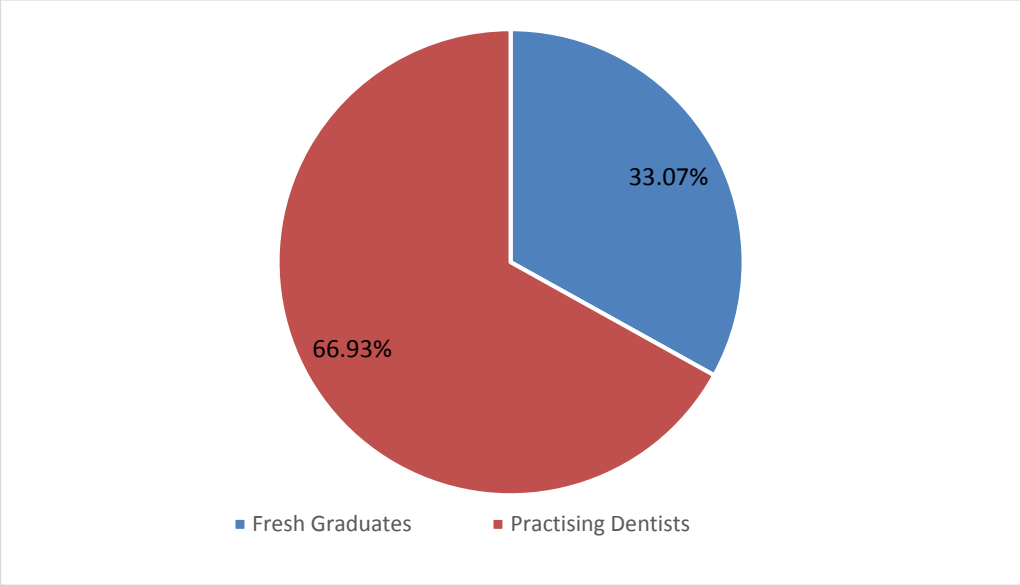

Figure 1: Frequency of fresh graduates and practicing dentists

Most of the participants (71.53%) were aware of guidelines for antibiotic use as shown in figure 2.

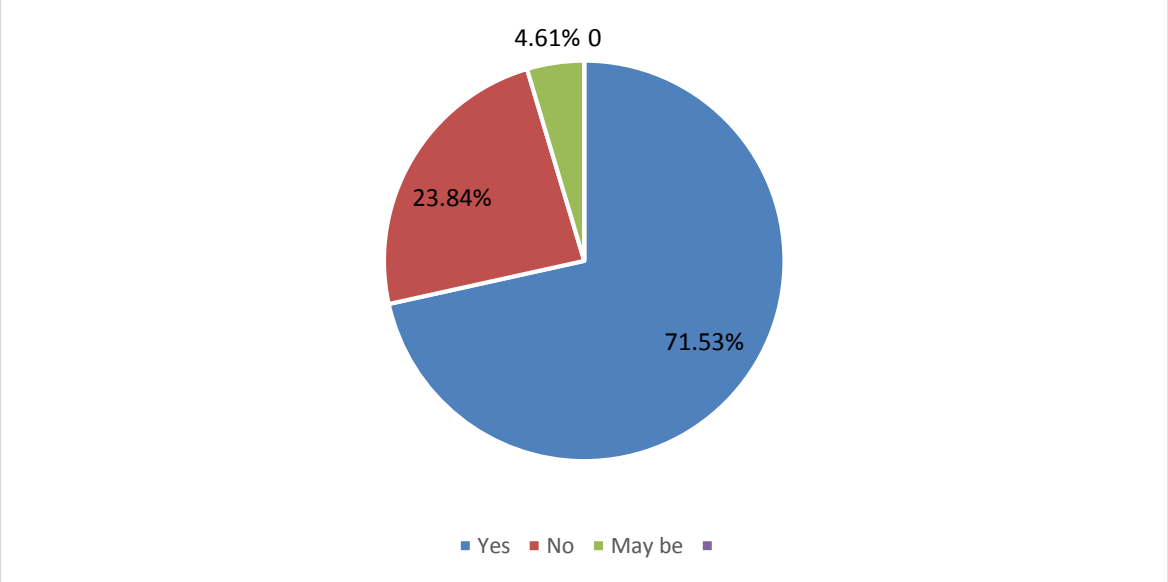

Figure 2: Knowledge of the guidelines and principles for prescription of antibiotics

This knowledge most had attained from college lectures or postgraduate training i.e. 28.46% and 24.61% respectively. Only 12.30% participants as a whole had attended a seminar or workshop in the last one year on recent guidelines for antibiotic prescription as indicated in figure 3.

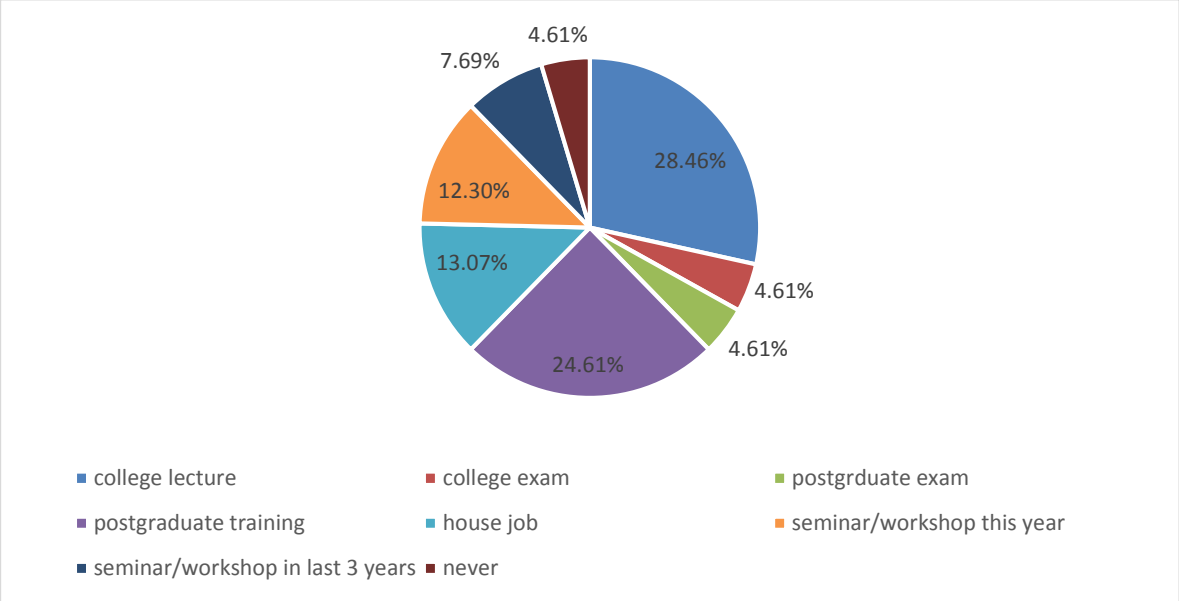

Figure 3: Last time attended a lecture/ seminar/ workshop or read an article or guideline regarding antibiotics.

Majority of the respondents were aware of the side effects of the drugs they were prescribing as presented in figure 4.

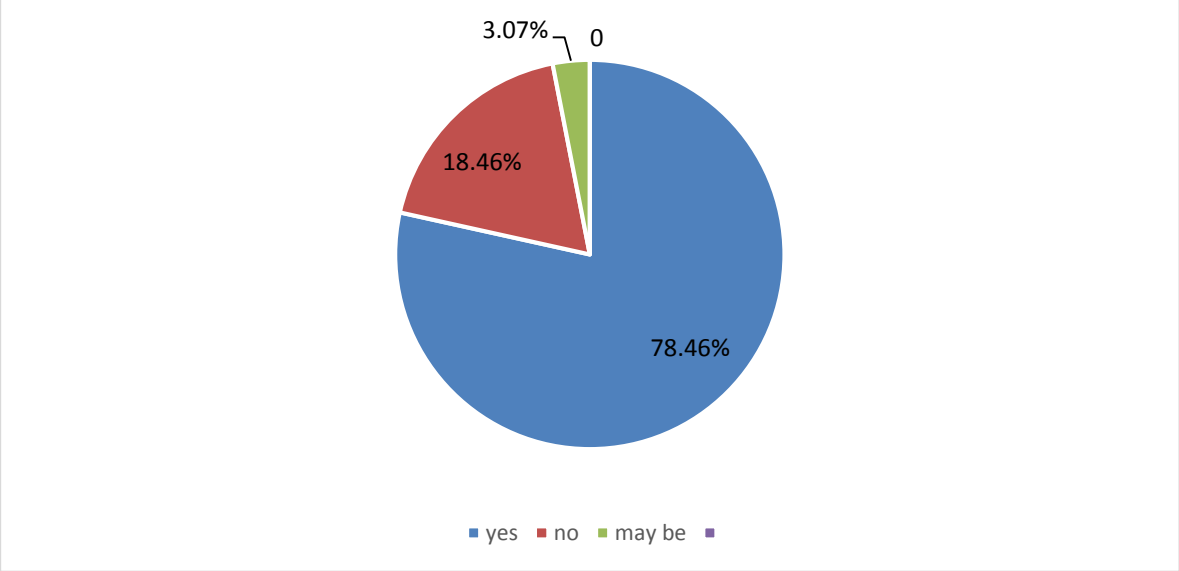

Figure 4: Aware of the side effects and drug overdose of the antibiotics prescribed

When asked about the average endodontic cases attended in a day 54.61% attended 5-10 and 40.76% attended 10-20 cases as indicated in figure 5.

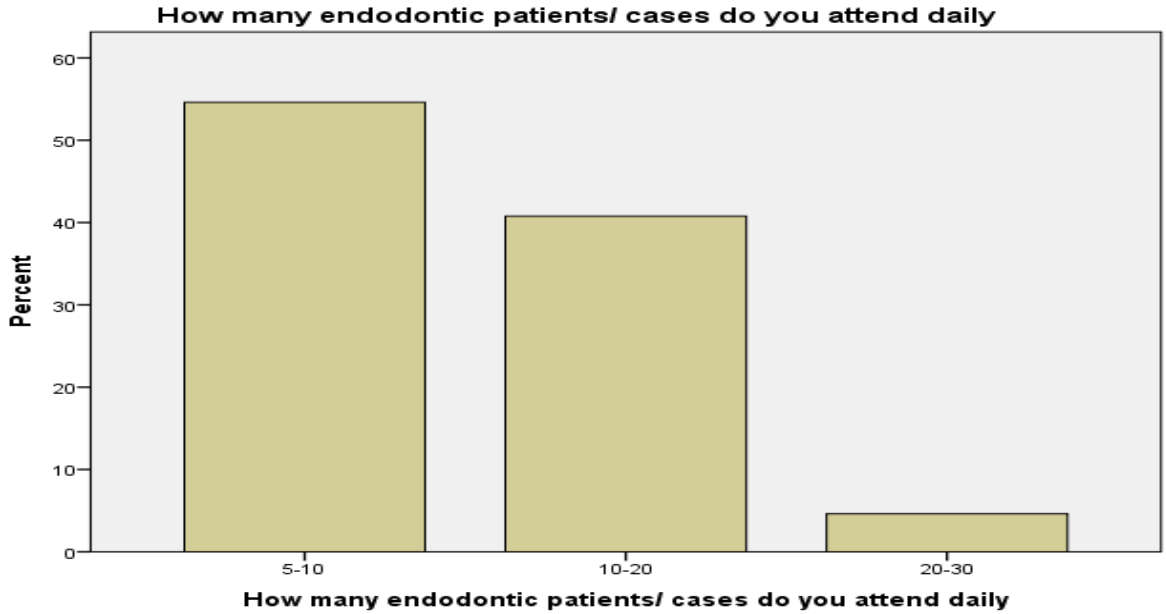

Figure 5: Endodontic cases attended daily.

For these cases needing endodontic treatment daily 2-3 cases were being prescribed antibiotics by 42.30% of the respondents and 0-1 were being prescribed by 23.07% respondents in general. Interestingly with a p= 0.280 there was no significant association between antibiotic prescriptions on daily bases with category of the dentist i.e. DPL or HO as summarized in table 1.

Table 1: Number of antibiotic prescriptions on daily bases with category of the dentist.

	No. Of patients prescribed antibiotics daily n (%)						Total	p-value
	0-1	2-3	4-5	6-7	8-9	10		
Fresh Graduate(HO)	8 (18.60)	24 (55.81)	6 (13.95)	3 (6.97)	2 (4.69)	0 (0.0)	43 (33.07)	0.280
Dental practitioners'(DPL)	22 (25.28)	31 (35.63)	12 (13.79)	11 (12.64)	9 (10.34)	2 (2.29)	87 (66.93)	
Total n (%)	30 (23.07)	55 (42.30)	18 (13.84)	14 (10.76)	11 (8.46)	2 (1.53)	130 (100)	

Chi-Square test where p value significant at < 0.05.

Table 2: Antibiotic preference of respondents if they advised antibiotics for dental infections.

	Antibiotic of choice for dental infections n (%)				Total n (%)	p-value
	Penicillin	Cephalosporin	Macrolide	Quinolones		
Fresh graduates(HO)	29(67.44)	07(16.27)	03(6.97)	04(9.30)	43(33.07)	.760
Dental practitioners(DPL)	54(62.06)	21(24.13)	06(6.89)	06(6.89)	87(66.93)	
Total n (%)	83(63.84)	28(21.53)	09(6.92)	10(7.69)	130(100)	

Chi-Square test where p value significant at < 0.05.

There was no statistical significance found between the category of respondent i.e. HO or DPL and type of antibiotic advised. Figure 6 explains that every (100%) respondent would advise antibiotic for apical periodontitis with cellulitis and only 2.3% would advise for symtomatic irreversible pulpitis.

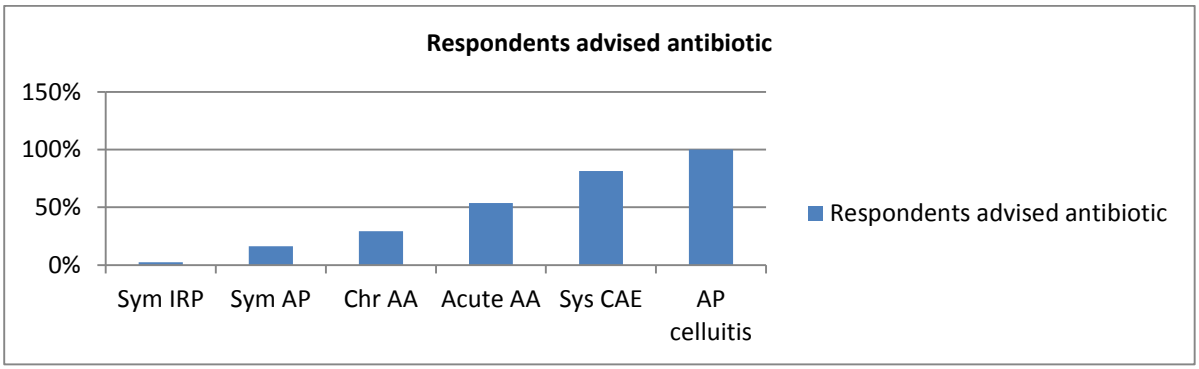

Figure 6: Antibiotic prescription by respondents in different endodontic pathologies.

Note

Sym IRP is(symtomatic irreversible pulpitis)

Sym AP is (symtomatic apical periodontitis)

Chr AA is (chronic apical abscess)

Acute AA is (acute apical abscess)

Sys CAE is (systemic condition with endodontic)

AP cellulitis is (apical periodontitis with cellulitis)

Based on the two categories i.e. HO and DPL Table 3 gives a description of the antibiotic prescribing trends as per the 1-7 clinical scenarios.

Table 3: The respondent's antibiotic prescribing trend in the different clinical scenarios.

	Scenario 1 n (%)		**Scenario 2 n (%)**		**Scenario 3 n (%)**		**Scenario 4 n (%)**		**Scenario 5 n (%)**		**Scenario 6 n (%)**		**Scenario 7 n(%)**	
	Yes	**no**	**Yes**	**No**	**yes**	**no**	**yes**	**no**	**yes**	**no**	**yes**	**no**	**yes**	**no**
Fresh graduates	6 (13.95)	37 (86.04)	36 (83.72)	7 (16.27)	8 (18.60)	35 (81.39)	17 (39.53)	26 (60.46)	27 (62.79)	16 (37.20)	27 (62.79)	16 (37.20)	37 (86.04)	6 (13.95)
Practicing dentists	5 (5.74)	82 (94.25)	77 (88.50)	10 (11.49)	17 (19.54)	70 (80.45)	33 (37.93)	54 (62.06)	39 (44.82)	48 (55.17)	66 (75.86)	21 (24.13)	76 (87.35)	11 (12.64)
p value	0.108		0.308		0.550		0.504		0.040		0.090		0.518	

Chi-Square test where p value significant at < 0.05.

There was no statistical significance between HO and DPL in prescribing antibiotics in all scenarios accept in scenario 5 (p =0.040).

Discussion

The response rate to our online survey was 86.6%. Despite their benefits, web surveys often have lower response rates from respondents than traditional survey methods. Hence this response can be considered a satisfactory response[13,14]. Maslamani and Sedeqi used questionnaires to investigate prescribing habits of antibiotics and analgesics among dentists for endodontic infection, with a response rate of 75.6 % [15], which is similar to the current study. But contrary to Navabizadeh et al. in Iran, to assess antibiotic prescriptions for endodontic infection and reported a response rate of only 46.5% [16]. In this study we used a convenience sampling method as invitations were sent after approximation of total staff and fresh graduates of the three dental institutes of the region. This could be the main reason for our good response rate. Similar to our results of 71.5%, most of the respondents were aware of the antibiotic guidelines in a study by Al Masan et al[17] which investigated the same topic (60%). Similar to the study by Al-Huwayrini et al[18] most respondents (78.56%) were aware of the side effects and overdose effects of the antibiotics they prescribed. The possible explanations to these findings are 1.That the respondents had been up to date on the aforementioned topics 2. These

guidelines have not changed over the last time they were informed. But contrary to explanation 1 only 12.30% respondents in all categories i.e. HO or DPL had attended a recent workshop or seminar on this topic. This is a similar result to a study conducted in Chennai, India. In which 82.35% never attended a workshop or seminar in their careers[19].

In this study results it was found (table1) that there was no association between the experiences of dentist to the amount of daily prescribed antibiotics. This finding is apart from the normal as usually there is statistical significance of dentist experience and specialty with the frequency of prescribing antibiotics as reported in a study in USA and Kuwait in which senior endodontists irrespective of endodontic conditions were prescribing antibiotic more frequently[20,21]. Conclusions cannot be made on these findings as frequency of endodontic patients and type of dental OPD the dentist attends also needs to be considered. On the topic of genre of antibiotics prescribed (table2). In both categories HO and DPL (67.44% and 62.06%) penicillin's were the preferred choice of antibiotics. Hence no association could be drawn for type of antibiotic with category of dentist (p-value =0.706). This finding corresponds with national and international literature. In 2020 a survey was conducted in a dental institute of Pakistan (Karachi) where it was found that 91.8% of the dentist prescribed amoxicillin as the first choice of antibiotic[3]. Similarly in 2000 a national survey was conducted in the USA where 61.48% endodontists preferred penicillin. But, 7.49% (table 2) of all the respondents would advise Quinolones as antibiotic for endodontic condition in our study. This is not at all a recommendation by guidelines[7] of endodontic treatment and needs to be further investigated. In the present survey (Figure 6) every respondent (100%) would advise antibiotics for apical periodontitis associated with cellulitis i.e. Sign of spread of infection which is a correct trend and also followed internationally. Reported by a review article that for the condition of necrotic pulp and diffused swelling the highest percentage of antibiotics' were being prescribed (87.6%)[7,22].

In the third section of the questionnaire 7 clinical scenarios were put forward to the respondents to decide if they would advise antibiotics "yes" or "no" in closed end questions. In scenario1 a case of simple irreversible pulpitis with no systemic manifestation 13.67% HOs and 5.74% DPLs would advise antibiotics (Table 3). This is not a recommendation and clearly a wrong practice of over prescribing antibiotics. Similar findings were reported in a study in Begum and Saudi Arabia in which 4.2% & 5.4% dental practitioners' prescribed antibiotics for the same endodontic condition[23, 24]. Literature reports that a major concept of practitioners' behind this practice is the satisfaction of the patients only and that dentist is aware that the drug has no significant role in the treatment[22]. Scenario 2 was a case of acute apical abscess with fever. According to the guidelines it is an indication for systemic antibiotic prescription[7,8,22]. In the study (table 3) most respondents 88.7% and 88.5% in both categories of dentist responded with "yes". Concluding that their judgment based on their knowledge is correct and for the respondents who answered "no" a likely explanation is that they might have interpreted that scenario differently. As something similar was reported in a survey[24] where in the questionnaire on the same topic the author used the word "feverish" which mislead the participants. Pointing out the disadvantages of a clinical scenario based survey.

Scenario 3 was a case needing retreatment. Based on guidelines the correct answer was "no" which was also our findings in the study (table 3). Minority of the respondents in both categories HOs and DPLs (18.6%and 19.5%) decided that antibiotics where required. Literature presented that a national survey in USA and Iran had reported respondents 15.04% and 42% respectively that considered antibiotics for cases of retreatment[16,20]. All the results presented are different leading us to two conclusions that either there is still confusion among

dentists in retreatment cases or that the clinical case presented in the surveys were not done correctly. Scenario 4 was a case of failed inferior alveolar block (IANB) on a patient with symtomatic irreversible pulpitis. In this study 39.5% HOs and 37.9% DPLs were prescribing antibiotics for failed IANB. This is contrary to a study in a dental institute of Asir where only 13% would do so for a case of failed IANB[24]. These results surely highlight a concern as there are no indications for antibiotics in such a scenarios and a set sequence of alternative techniques advised for management[25]. Scenario 5 a case of endodontic flare-up presented that 62.7% of HOs and 44.8% of DPLs would advise antibiotics.

A study in the UAE in 2020 reported that only 6.6% general dentists prescribed antibiotics for endodontic flare-up which is an incorrect practice. Statically significance was found (table 3) were p =0.040 for scenario 5 between the two categories of dentists. This presented an association between the fresh graduates and the incorrect practice of advising antibiotics in endodontic flare ups in our study. Studies and guidelines have concluded that flare ups are an inflammatory response and not a sign of spread of infection. So, these conditions only require counseling of patient and pain management with no role of antibiotics[7, 27]. Scenario 6 was a case of symptomatic apical periodontitis associated with facial swelling (peri-orbital area). This case presented a typical endodontic emergency which advocates the use of systemic antibiotics[28, 29]. In the present study 62.7% and 75.8% respondents in both categories of dentists would follow the recommendations. Similar results (62.9%) were found in a recent study where respondents from former Soviet Union states (FSU) would advise antibiotics in cases that require antibiotic use.

As not every respondent's response was according to guidelines we must understand that prescription of systemic antibiotics when not recommended may lead to antimicrobial resistance, whereas non-prescription when necessary may have detrimental health consequences[30]. So, the practitioners' knowledge of current guidelines is of utmost importance. The last scenario 7 was case of acute apical abscess with no systemic sign symptoms but patient was a controlled diabetic on insulin. Present study results showed that 86.04% of HOs and 87.35% of DPLs would prescribe antibiotics to this patient. Highlighting yet another misuse of systemic antibiotics according to the guidelines for endodontic treatments[7, 8, 20]. Similar findings (76.3%) were presented by a study in Saudi Arabia and UK[17, 24]. In the present study the reason behind this could be the addition of a systemic disease of patient in the clinical scenario misleading the respondents. Although a controlled diabetic patient does not require antibiotics but this could have caused some confusion.

Conclusion

Considering the draw backs of this online survey further investigation are needed to draw definitive conclusions on why there is misuse and overuse of systemic antibiotics by practitioners. Qualitative results could not be attainted because of close ended questions since rationale from respondents on their answers was not taken. This survey was only of a region of Pakistan and since a formal data base of all dental practitioners could not be accessed our results should be considered a superficial assessment of the discussed topic. Still there can be no denying that antibiotic misuse is still a major problem around the world as well as Pakistan as repeatedly reported in previous literature and our current study. Based on the findings the following suggestions can be critical in Pakistan to improve dentist's antibiotic prescription patterns.

1. Ensuring that dental students are well-informed on the use of systemic antibiotics in the treatment of endodontic pathology.

2. Through continuing professional development of dentists, that will be keeping them up to speed on international criteria for antibiotic prescription.

3. Enact and enforce laws and regulations prohibiting the selling of antibiotics over-the-counter.

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APPENDIX:

Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

Checklist Item	***Explanation***
Survey design	Total of 150 invitations were sent. The expected participants were from the population fresh graduates and dentist with permanent licenses affiliated with the three dental colleges and hospitals of Abbottabad.
Ethical approval	# WMC/RMDTH/EC/2084.
Informed consent	'Participants' information sheet (PIS)', was the first page in the online survey. It includes all the information that participants need to know in the regards of the research such as the research title, aim and objectives and researchers' contact details. Consent: Participant went to next page i.e. Questionnaire only if they gave consent of participation.
Data protection	Guaranteed by the principal researcher personal login to the Google Forms account with username and password
Development and testing	The survey questions were constructed by the research team (which contains two endodontic consultant and two genera dentists with 5 years' experience) and prepared on Google Forms by the principal researcher. Procedure and items of the survey were piloted, adapted, and approved by the research team.
Open survey versus closed survey	An "open survey"
Contact mode	Initial contact with the potential participants was made on the Internet. The survey forms where sent by Emails and Whattsapp.
Advertising the survey	Announcements where sent on social media groups i.e. Whattsapp and Face book. Link of the survey was also shared on these groups and some E mails contacts.
Web/E-mail	Google Forms
Context	Google Forms is an application/ website for constructing, storing, and analyzing online surveys. The administrator can design the length, the kind of information provided and the type of questions & answers.
Mandatory/voluntary	A voluntary survey
Incentives	No incentives

Time/Date	In what timeframe were the data collected?
Randomization of items or questionnaires	No randomization was performed
Adaptive questioning	Does not apply to this survey
Number of Items	**Section 1:** information sheet & consent**.** **Section 2: 08** general information questions. **Section 3: 07** clinical scenario questions.
Number of screens (pages)	4 screens /pages.
Completeness check	With incomplete answers, an alert like (an answer is required) was required before the respondent could continue. However, the survey did not contain alternative answers such as (don't know).
Review step	Respondents had the option to switch between pages by using (go back to) and (proceed) buttons, and to change answers.
Unique site visitor	Only respondents or visitors completing at least the first page (which is the consent form) and proceeding to the next page were counted. For this, calculation of views or respondents' rates was not possible.
View rate (Ratio of unique survey visitors/unique site visitors)	Not applicable as the calculation of unique site visitor was not possible in this survey.
Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Not applicable as the calculation of participation rate was not possible in this survey because of participants could not proceed if they did not agree to the consent form (first page).
Completion rate (Ratio of users who finished the survey/users who agreed to participate)	Not applicable as the calculation of is ratio was not possible with this format.
Cookies used	No cookies were used to assign a unique participant identifier to each participant's device. As personal information was not collected, we could not prevent duplicates entries.
Log file analysis	Log file for identification of multiple entries were not used.

Registration	**Not required** (open survey)
Handling of incomplete questionnaires	Respondents' answers were included only if they completed the full questionnaire. Respondents' who dropped out before completing, their answers were not included in the analysis.
Questionnaires submitted with an atypical timestamp	The average time to answer the questions was timed approximately 10 minutes, but there was no minimal time required.
Statistical correction	**No statistical correction was needed**

This checklist has been modified from Eysenbach G. Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES). J Med Internet Res. 2004 Sep 29;6(3):e34 [erratum in J Med Internet Res. 2012; 14(1): e8.]. Article available at https://www.jmir.org/2004/3/e34/; erratum available https://www.jmir.org/2012/1/e8/. Copyright ©Gunther Eysenbach. Originally published in the Journal of Medical Internet Research , 29.9.2004 and 04.01.2012.