

THE PREVALENCE OF ANTIBIOTIC ABUSE DURING ENDODONTIC TREATMENT

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ABSTRACT

Objective: To assess prevalence of antibiotic misuse in the patients of endodontic disease reporting to the Department of Operative Dentistry and Endodontics, at tertiary care Hospital, Karachi.

Materials and methods: Descriptive cross-sectional study was carried out at the Department of Operative Dentistry and Endodontics, Hamdard University Dental Hospital, Karachi. The research subjects were 165 patients aged 15 to 55 years who had a history of irreversible pulpitis and were sampled using non-probability consecutive sampling method. Data were gathered by a modified structured questionnaire on demographic characteristics, antibiotic-use practices, rationale for antibiotic use, self-medication and disposal of surplus antibiotics. Antibiotic misuse was calculated as a score of > 7 on the 15-question antibiotic misuse questionnaire. SPSS 26 software was used to analyze the data. $p < 0.05$ was considered statistically significant.

Results: The mean age of participants was 34.6 ± 10.7 years, and 87 (52.7%) were female. In total, 57.0% (94) of respondents exhibited antibiotic misuse. 54 (32.7%) said they self-medicated and 61 (37.0%) said that they stored the remaining antibiotics for subsequent use. 63 (38.2%) respondents reported that they used antibiotics most often for dental pain. When analyzed for association by gender, age ($p = 0.041$) and antibiotic use in last 6 months ($p < 0.001$) were significant but not gender ($p = 0.416$).

Conclusion: There was a high rate of antibiotic misuse amongst the endodontically treated patients. Better education of patients, more judicious prescribing and better antimicrobial stewardship were needed to reduce unnecessary antibiotic use, and limit antimicrobial resistance.

KEYWORDS: Anti-Bacterial Agents; Endodontics; Pulpitis; Self Medication; Treatment Misuse.

INTRODUCTION

Antibiotics play a significant role in the treatment of odontogenic and endodontic infections especially in the presence of systemic involvement, spreading cellulitis and risk of dissemination. Yet, they are often used when definitive local treatment (e.g. root canal treatment and drainage) would be adequate. Antimicrobial resistance and unnecessary side effects to the patient are the result of inappropriate prescribing. The survey conducted in Northern Morocco revealed that there was variation in the knowledge and decisions about antibiotic use in the treatment of endodontic infections [1]. The same was found among Iraqi dentists who reported prescribing systemic antibiotics for some dental conditions even though they were not indicated for it [2].

International comparisons showed that there was a range of dental antibiotic use in Australia, England, the United States and British Columbia; these differences were likely due to practice patterns and clinical factors at the local level [3]. Use of systemic antibiotics remained high in primary dental practice in Germany with longitudinal data, highlighting the need for prescribing surveillance and stewardship [4]. Awareness and confidence in antimicrobial prescribing is also starting to become an issue during professional training, with dental students from varied geographical areas demonstrating varying levels of awareness of antimicrobial resistance [5].

Qualitative evidence from outpatient dental practice suggested that factors of diagnostic uncertainty, patient expectations, time pressure and clinicians' perception of risk may influence decisions made [6]. Dentists in India exhibited varying levels of knowledge, attitudes, and practices when it came to antibiotic use in endodontics [7]. Clinical outcome studies of endodontic infections also underscored the importance of judicious prescribing of systemic antibiotics [8]. Antibiotics were not found to be a substitute for proper local endodontic treatment in the absence of systemic signs in apical periodontitis [9]. Other surveys from Morocco also revealed differences in antibiotic choice, indications and duration of prescription [10]. These findings helped to support the need to determine the extent of inappropriate prescribing of antibiotics during endodontic treatment and evidence gaps in care-based prescribing.

This study was conducted as there had been a longstanding concern on inappropriate prescribing of antibiotics in endodontics across various settings. This was designed to assess the extent of misuse, understand prescribing trends, and offer data that could inform safer prescribing and antimicrobial stewardship.

METHODS

The current study was a descriptive cross-sectional study, conducted in Dental OPD, Department of Operative Dentistry and Endodontics, Hamdard University Dental Hospital, Karachi. Sample size was determined using the OpenEpi software version 3 with the following parameters: expected antibiotic use frequency of 30%, Confidence Interval (CI) of 95% and margin of error of 7%. The sample size was calculated to be 165 patients. Consecutive sampling technique was employed for recruitment and it was a non-probability sampling technique.

Patients of both sexes aged 15-55 years who gave informed consent and had a history of irreversible pulpitis were selected for the study. Those who could not afford the full treatment and those who had allergy history were excluded as well as those who had intraoral or extraoral swelling signs/symptoms. All participants provided informed written consent and confidentiality of information was kept throughout the study.

Information was gathered by a modified questionnaire which contained some demographic data and questions on antibiotic use, such as time of antibiotic use and the reasons for using the antibiotic. Patients' knowledge and attitudes towards antibiotics were also evaluated on the questionnaire and some clinical parameters associated with endodontic therapies were also noted. The assessment of antibiotic misuse was based on the answers given in the questionnaire, with a score of >7 out of 15 points being positive for antibiotic misuse. Potential confounding variables such as gender and age were controlled by stratification and selection bias was minimized by adhering to the predetermined inclusion and exclusion criteria.

SPSS version 26 was used for data analysis. Quantitative variables, such as age, were presented as mean and standard deviation or median and interquartile range, as appropriate. The Shapiro-Wilk test was used to test for normality of quantitative data. Qualitative variables (gender and antibiotic misuse) were described in frequency and percentages. Chi square test or Fisher exact test whichever was appropriate was used after stratification and a p value of <0.05 was taken as statistically significant.

RESULTS

A total of 165 patients diagnosed with irreversible pulpitis were included in the study. The mean age of the participants was 34.6 ± 10.7 years. Among the study participants, 40 (24.2%) were aged 15 to 25 years, 49 (29.7%) were aged 26 to 35 years, 45 (27.3%) were aged 36 to 45 years, and 31 (18.8%) were aged 46 to 55 years. Regarding gender distribution, 78 (47.3%) participants were male and 87 (52.7%) were female. The demographic characteristics of the study participants are presented in **Table 1**.

Regarding antibiotic-related practices, 112 (67.9%) participants reported using antibiotics during the previous six months, whereas 53 (32.1%) had not used antibiotics during this period. When participants were asked about their usual method of taking antibiotics, 90 (54.5%) reported taking them according to a dentist's prescription, 54 (32.7%) reported self-medication, and 21 (12.7%) reported taking antibiotics according to a previous prescription. Regarding the handling of leftover antibiotics, 61 (37.0%) participants reported keeping them for future use, 73 (44.2%) discarded them, and 31 (18.8%) returned them to a pharmacy.

Regarding the reason for antibiotic consumption, 63 (38.2%) participants reported taking antibiotics for dental pain, 58 (35.2%) for swelling, and 44 (26.7%) for fever. Based on the predefined questionnaire scoring criteria, a score greater than 7 out of 15 was considered indicative of antibiotic misuse. Overall, antibiotic misuse was identified in 94 (57.0%) participants, while 71 (43.0%) participants did not meet the criteria for antibiotic misuse. The antibiotic-use practices and prevalence of antibiotic misuse among the study participants are presented in **Table 2**.

The association between antibiotic misuse and selected characteristics was assessed after stratification. Among participants aged 15 to 25 years, antibiotic misuse was observed in 27 (67.5%), whereas 13 (32.5%) did not demonstrate misuse. In the 26 to 35-year age group, 31 (63.3%) participants demonstrated antibiotic misuse compared with 18 (36.7%) who did not. Among participants aged 36 to 45 years, antibiotic misuse was observed in 24 (53.3%), while 21 (46.7%) showed no misuse. In the 46 to 55-year age group, 12 (38.7%) participants demonstrated antibiotic misuse and 19 (61.3%) did not. A statistically significant association was observed between age group and antibiotic misuse ($p=0.041$).

Among male participants, 47 (60.3%) demonstrated antibiotic misuse and 31 (39.7%) did not, while among female participants, 47 (54.0%) demonstrated antibiotic misuse and 40 (46.0%) did not. The association between gender and antibiotic misuse was not statistically significant ($p=0.416$).

Among the 112 participants who had used antibiotics during the previous six months, 75 (67.0%) demonstrated antibiotic misuse, while 37 (33.0%) did not. In comparison, among the 53 participants who had not used antibiotics during the previous six months, 19 (35.8%) demonstrated antibiotic misuse and 34 (64.2%) did not. A statistically significant association was observed between antibiotic use during the previous six months and antibiotic misuse ($p<0.001$). The association of antibiotic misuse with selected characteristics is presented in **Table 3**.

Table 1. Demographic characteristics of the study participants (n=165)

Variable	n (%) / Mean $\pm$ SD
Age (years)	34.6 $\pm$ 10.7
Age group (years)	
15 to 25	40 (24.2)
26 to 35	49 (29.7)
36 to 45	45 (27.3)
46 to 55	31 (18.8)
Gender	
Male	78 (47.3)
Female	87 (52.7)

Age was presented as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequency and percentage, n (%).

Table 2. Antibiotic-use practices and prevalence of antibiotic misuse among study participants (n=165)

Variables	n (%)
Antibiotic use during the previous 6 months	
Yes	112 (67.9)
No	53 (32.1)
Usual method of taking antibiotics	
As prescribed by dentist	90 (54.5)
Self-medication	54 (32.7)
Following a previous prescription	21 (12.7)
Handling of leftover antibiotics	
Kept for future use	61 (37.0)
Discarded in trash	73 (44.2)
Returned to pharmacy	31 (18.8)
Usual reason for taking antibiotics	
Pain	63 (38.2)
Swelling	58 (35.2)
Fever	44 (26.7)
Antibiotic misuse	94 (57.0)

Table 3. Association of antibiotic misuse with selected characteristics (n=165)

Variables	Antibiotic misuse n (%)	No antibiotic misuse n (%)	p-value
Age group (years)			0.041*
15 to 25	27 (67.5)	13 (32.5)	
26 to 35	31 (63.3)	18 (36.7)	
36 to 45	24 (53.3)	21 (46.7)	
46 to 55	12 (38.7)	19 (61.3)	
Gender			0.416
Male	47 (60.3)	31 (39.7)	
Female	47 (54.0)	40 (46.0)	
Antibiotic use during previous 6 months	75 (67.0)	37 (33.0)	<0.001*

Chi-square test/Fisher's exact test was applied as appropriate. A p-value <0.05 was considered statistically significant.

DISCUSSION

In the present study, 165 patients with irreversible pulpitis were evaluated for antibiotic misuse and 57.0% of them met the criteria for antibiotic misuse. This result showed that the abuse of antibiotics was frequent among endodontic treatment consumers. Over two thirds of the participants had taken antibiotics in the past six months and about one third self-medicated. This was in line with the general problem of irrational prescription of antibiotics in dentistry. The magnitude of inappropriate antibiotic prescribing in dentistry was large and Rodríguez-Fernández et al. showed that inappropriate prescribing was still a major issue deserving targeted antimicrobial stewardship measures [11].

These findings of antibiotic misuse in the present study were also corroborated by the findings of endodontic conditions where antibiotics were dispensed even with few clinical indications. In a systematic review and meta-analysis, Méndez-Millán et al. showed that there was a significant amount of antibiotic overprescription in the

management of apical periodontitis. They found that antibiotics were still being prescribed for clinical conditions that were generally amenable to definitive local treatment, such as root canal treatment, drainage or extraction, especially when there was no systemic involvement [12]. The high prevalence found in the present study was thus an important gap between proper endodontic management and antibiotic-use behaviour.

In this study, 32.7% of the respondents mentioned self-medication and another 12.7% mentioned use of antibiotics on the basis of a previous prescription. Also, 37.0% stored unused antibiotics for future use. Such behaviours might make repeated antibiotic use possible without proper clinical evaluation. Galić et al. came to the conclusion that there are inappropriate attitudes in prescribing antibiotics and gaps in knowledge of dentists in Bosnia and Herzegovina when dealing with endodontic diseases, and that there is still a significant gap between the recommended indications and the use of antibiotics [13].

In the current study, the reason for using antibiotics was most commonly pain (38.2%) followed by swelling and fever. This was clinically relevant as dental pain alone does not automatically indicate systemic antibiotic treatment, especially in cases of irreversible pulpitis with no involvement of the systemic tissues. The same variation in antibiotic-prescribing habits for endodontic therapy was also observed in Croatia, and the importance of better adherence to the evidence-based indications for the use of systemic antibiotics was pointed out by Sović et al [14]. These observations indicated that symptoms alone, like pain, may be misinterpreted as an indication for antibiotic therapy, rather than primarily managing these symptoms by definitive endodontic treatment.

Misconceptions may arise in antibiotic indications even during dental education. Khalaf et al. showed antibiotic prescribing by dental students in various pulpal and periapical conditions where systemic antibiotic therapy was not routinely indicated. Their study showed that there were differences among dental faculties and that better educational approaches were needed to reinforce their knowledge about indications for antibiotic therapy in endodontics [15]. These were pertinent to the current study as mis prescribing would in turn affect patients' perceptions that all dental pain required antibiotics.

The current results were especially applicable to the local situation. Yaqoob et al. assessed the antibiotic overprescription by dentists in endodontic emergencies in Karachi and revealed that the antibiotic overprescription occurs despite knowing the guidelines for prescribing antibiotics. They found that pulpectomy along with analgesics and antibiotics was the treatment of choice for irreversible pulpitis for 45.48% and for acute apical periodontitis for 37.9% [16]. This local evidence suggested that there may be a high exposure of antibiotics to patients in Karachi during endodontic treatment, which would in turn reinforce their further self-medication or re-use of previous treatments.

The present study also revealed that age factor was significantly associated with antibiotic misuse ($p=0.041$) with highest misuse rate of 67.5% seen in age group 15-25 years and lowest rate of 38.7% in the age group 46-55 years. This result indicated that younger patients may have been more prone to inappropriate antibiotic-use practices, but this should be interpreted with caution since many of the studies used to evaluate endodontic use of antibiotics evaluated the prescriber rather than the patient. In Malaysia, Al-Haddad et al. revealed that clinical experiences and the frequency of endodontic treatment had an influence on the prescription of antibiotics and most of the general dental practitioners had inadequately prescribed antibiotics [17]. These results suggested that clinical, demographic, and educational factors other than age might affect antibiotic use behavior.

In the current study, a positive correlation was seen between the past use of antibiotics and misuse. 67.0% of the participants who used antibiotics in the past six months had antibiotic misuse, while only 35.8% of those who did not use antibiotics in the past six months used antibiotics in an inappropriate manner, and this was significant ($p<0.001$). Also, Geethapriya and colleagues found significant misuse of antibiotics associated with root canal therapy. Only 6.5% of the dentists who responded to their survey said that they did not prescribe an antibiotic course of treatment for root canal treatment, and 57% prescribed both antibiotics and analgesics [18]. Frequent use might therefore lead to increased awareness of antibiotics and may lead to repeat antibiotic usage, keeping antibiotics on hand, or self-medicating for later dental symptoms.

Although the number of antibiotic misuses was higher among males compared to females, there was no significant association between gender and antibiotic misuse in the present study ($p=0.416$). This indicated that inappropriate antibiotic-use behaviour was not greatly influenced by gender in this sample. The same was true for uygun and Doğan who observed only statistically significant gender difference in one of the scenarios assessed for antibiotic decision-making among final-year dental students [19]. Their sample size was different from the current patient-based sample, but their results indicated that other factors may be more important regarding inappropriate antibiotic use than gender.

It was also recently shown that over-prescription of antibiotics was not limited to adult endodontics. In a systematic review and meta-analysis of antibiotic prescriptions for pulpitis in paediatric dentistry conducted by Machuca-Portillo et al., rates of antibiotic prescribing ranged from 0.6% to 50.0% with a pooled prevalence of 14.0%. They stressed that the operative treatment of the pulpitis was mainly local and that antibiotics were generally only indicated in cases of systemic involvement or spreading infection [20]. This confirmed the general findings that excessive antibiotic use associated with pulpal disease was an issue in various patient populations and clinical environment.

The general results of the present study showed that misuse of antibiotics is prevalent among the endodontics population. Self-medication, reusing old antibiotics, keeping leftover antibiotics and using antibiotics for dental

pain were significant problem areas of concern. The strong relationships with age and recent antibiotic use indicated that patient specific education may be beneficial, especially in younger people and those with regular antibiotic exposure. But results of this study should be interpreted with caution when compared with previous studies as many studies reviewed focused on dentists' prescribing patterns rather than actual misuse at the patient level. The cross-sectional study design and relying on self-reported questionnaire responses also prevented the ability to determine cause and effect and may have led to recall or reporting bias. Further research with larger multicenter samples and well-designed patient-centered assessment tools of misusing antibiotics would help to explain the factors that are associated with inappropriate antibiotic use in endodontic treatment.

CONCLUSION

Based on findings from the present study, antibiotic misuse was found to be prevalent in the population of patients receiving endodontic treatment, and over half the population had inappropriate antibiotic-use practices. Common behaviours included self-medication, reuse of previous antibiotics, storage of surplus antibiotics for future use and use of antibiotics for dental pain. The use of antibiotic in the last 6 months was a significant risk factor for antibiotic misuse, but not gender, while age was significant. These results emphasized the importance of better educating the patients on the proper indications, duration and usage of antibiotics under endodontic conditions. Improved antimicrobial stewardship, dissuading the practice of self-medication, and raising awareness for the importance of definitive endodontic care instead of unnecessary antibiotic use can help decrease inappropriate antibiotic use and play a role in controlling antimicrobial resistance.

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