Antibiotic and Analgesic Prescription Patterns among Dentists or Management of Dental Pain and Infection during Endodontic Treatment

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**Significance of the Study**

- Antibiotics and analgesics are necessary for controlling dental infection and pain; however, several studies from around the world have reported overprescription of these drugs. This study aimed at determining the prescription pattern in Kuwait in order that these medications are prescribed only when needed. Our results suggest the need for more education for dentists and patients related to antibiotic and analgesic prescription.

**Keywords**

Antibiotics · Analgesics · Pain management · Root canal treatment

**Abstract**

**Objective:** The aim of this study was to determine prescription patterns of antibiotics and analgesics among dentists in the management of dental pain and infection for medially healthy patients undergoing endodontic management. **Materials and Methods:** This descriptive cross-sectional survey was based on a structured questionnaire. The questionnaire collected data on age, gender, years of experience, and the qualifications of dentists. Feedback on prescription patterns for antibiotics and analgesics was collected for a number of clinical scenarios. Participants’ choices regarding the type, dose, and duration of antibiotics/analgesics were recorded. Completed questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS; version 24) to determine relationships between prescription patterns, age, gender, and educational qualification. **Results:** Of the 227 participants surveyed, 190 (83.7\%) did not prescribe antibiotics for patients complaining of severe pain. There were significant associations between age and years of experience and antibiotic prescription for pain management ($p = 0.035$ and 0.04, respectively). Of the participants, 199 (87.7\%) never prescribed antibiotics for reversible pulpitis with normal periapical area; there was a statistical significance in relation to gender ($p = 0.044$). Amoxicillin 500 mg was prescribed most of the time (51.5\%). Diclofenac K (50 mg) was prescribed by 41\% of the participants, while 39.2\% of the participants very often prescribed ibuprofen (600 mg). **Conclusion:** Most dentists prescribed analgesics and antibiotics as recommended, but more education on the proper use of these medicines is needed for dentists and patients.
Introduction

Patients visit dental clinics mostly complaining of pain and/or swelling [1] and pain of odontogenic origin, e.g., dental caries with or without pulpal involvement. Most conditions can be treated by conventional management such as operative procedures, e.g., dental filling, nonsurgical root canal treatment, e.g., pulp extirpation, instrumentation, and intracanal medication, or extraction [1]. In certain cases, antibiotics and/or analgesics are indicated as adjuncts to conventional endodontic procedures [1].

There is a lack of clear guidelines for the use of antibiotics and analgesics in medically healthy patients as well as endodontic pain management strategies [1]. Diseases of the dental pulp and periapical tissue are mainly caused by microorganisms [2]; however, not all cases of endodontically involved teeth require the administration of systemic antibiotics [3]. The majority of endodontic infections do not require systemic antibiotic therapy when the cause of the infection has been properly managed (complete debridement of the pulp space and proper obturation and sealing of the pulp space from the oral environment). In healthy individuals, any bacteremia caused by endodontic treatments are rapidly scavenged without any complications [4].

According to the American Association of Endodontists (AAE) [3], antibiotic prescription in medically healthy patients is indicated when systemic manifestations and diffuse swelling are present. The AAE states that systemic antibiotic therapy is not routinely indicated, depending on the patient’s general medical status [3]. However, when the patient presents with diffuse facial swelling (cellulitis) resulting from an acute apical abscess or an infection with systemic involvement (fever or malaise), an appropriate regimen of systemic antibiotics (oral or intravenous) with proper endodontic management (removal of the cause) are the treatments of choice [3]. Similarly, the European Society of Endontology recommends adjunctive systemic antibiotic treatment in conjunction with endodontic therapy in an acute apical abscess with systemic involvement (localized fluctuant swellings, elevated body temperature >38°C, malaise, lymphadenopathy, trismus, and progressive infections (rapid onset of severe infection within 24 h, cellulitis, or a spreading infection and osteomyelitis) [5].

As culturing is seldom carried out, prescriptions are often based on presumption from clinical and bacterial epidemiological data [6]. As endodontic infections are usually polymicrobial, involving a combination of gram-positive and gram-negative facultative and/or strict anaerobic bacteria [2, 7, 8], broad-spectrum antibiotics are typically prescribed. Amoxicillin is the most frequently prescribed antibiotic during endodontic treatment [1].

As for pain management, there is insufficient evidence from the literature regarding the type and the dose of the analgesic needed, and whether the use of antibiotics helps in reducing pulpal pain. A number of studies have investigated the appropriateness of different analgesic compounds on the management of endodontic pain [9, 10]. Regarding antibiotic use to reduce dental pain, a Cochrane review confirmed the necessity for further larger-sample and methodologically sound trials that can provide additional evidence as to whether antibiotics can help with pain control in pulpal diseases [11].

A number of studies have investigated the appropriateness of different analgesic compounds on the management of endodontic pain [9, 10]. However, only 1 study has surveyed the analgesic prescription preferences of endodontists [12]; furthermore, strategies for endodontic pain management have not been formulated. Many practitioners confuse the need for analgesics for pain relief with the prescription of antibiotics [13].

Generally, there is inconsistency amongst dental practitioners with respect to the appropriate need, timing, and type of medication. A high level of inappropriate antibiotic prescriptions was observed amongst the dentists surveyed. It has been reported that in some countries dentist prescriptions of antibiotics in endodontic management can be inappropriate and unnecessary, even if infections are present [14–22]. Inappropriate use of antibiotics has to be discouraged, as overuse and misuse can have a negative impact on the general population [23] leading to adverse drug reactions, emergence and resistance of species, and increases in drug-resistant microbial infections and economic burden [24, 25].

Therefore, the aim of this survey was to determine the attitude and knowledge of both general dentists and specialists regarding antibiotic and analgesic prescriptions for medically healthy patients during endodontic management, and to determine the variables, if any, that may affect the prescription pattern. There is a lack of adequate information related to this topic in the Middle East and Gulf in general, and Kuwait in particular; the aim of this study was to shed light on antibiotic and analgesic prescription patterns of dentists in Kuwait.
Materials and Methods

This was a descriptive cross-sectional survey based on a structured questionnaire that was developed by the first author, which was modified from a previous study [26], to investigate antibiotic and analgesic prescription patterns for pain of endodontic origin and infection management. The questionnaire was distributed randomly to dental clinics in Kuwait in May 2017; 6 clinics were selected, 1 from each of the 6 Governorates of Kuwait. Precision estimates were employed to calculate the desired sample size, and subjects from different specialists and departments were selected using the random sample method. A sample of 300 was selected to provide a 95% confidence interval that a population proportion of 15% would provide estimates ±2.2%. This level of precision was regarded as sufficient for the study. The purpose of the study was explained in the covering letter of the questionnaire. Participating dentists signed an informed consent.

The questionnaire included demographic data such as age, gender, years of experience, and dental qualification (general or specialist); specialists were of different specialties, i.e. endodontists, prosthodontists, periodontists, oral surgeons, operative dentists, and advanced general dental specialists. Information regarding practitioners’ prescription patterns of antibiotics and analgesics was collected for a number of clinical scenarios associated with endodontic management. The questions were separate for the prescription of antibiotics and analgesics. Participants were asked to specify the type of antibiotic and analgesic they usually prescribe, if any. They were also asked specifically if they prescribed only analgesics or only antibiotics for patients with severe pain.

The clinical conditions represented in the questionnaire for pulpal diagnosis were reversible pulpitis with normal periapical area; symptomatic irreversible pulpitis with normal periapical area or symptomatic apical periodontitis; asymptomatic irreversible pulpitis with normal periapical area or symptomatic or asymptomatic apical periodontitis; or necrotic pulp with normal periapical area or symptomatic or asymptomatic apical periodontitis, or acute or chronic apical abscess. The respondents were asked to report whether they always or never prescribe antibiotics for the above conditions. Their choice regarding the type, dose, and duration of antibiotics as well as analgesics was recorded.

The completed questionnaires were coded and entered for analysis by SPSS (version 24). Descriptive statistics of the sociodemographic characteristics of the participants were prepared. Numerical data were expressed as means ± standard deviation or percentage, as appropriate. The test for associations between the pulpal diagnosis condition and the choice of the antibiotic and the analgesic was done using $\chi^2$ statistical measurements. The $\chi^2$ test was also used to measure possible significant effects of gender, age, experience, or educational qualification on the prescription of analgesics for dental pain management. The independent $t$ test was used for the estimation of the relationship between antibiotic prescription for patients complaining of severe pain and the age and experience of the practitioner. Associations between pulpal diagnosis and the choice of the antibiotic and the analgesic were studied using Spearman correlation. Data were interpreted as significant when $p > 0.05$. The Cronbach reliability test was used to calculate the reliability coefficient $\alpha$. The items for all had a Cronbach $\alpha$ coefficient of 0.77, indicating acceptable reliability.

Results

Of the 300 questionnaires distributed, 227 were completely filled and returned, which is a response rate of 75.6%. Participants ($n = 227$) were aged between 23 and 63 years, with a mean age of $35 \pm 8.22$ years. Forty three percent ($n = 97$) were males and 57% ($n = 130$) were females; 59.5% ($n = 135$) were general dentists and 40.5% ($n = 92$) were specialists. Of the 227 participants, 190 (83.7%) did not prescribe antibiotics for patients complaining of severe pain, while 16.3% ($n = 37$) did prescribe antibiotics for patients complaining of severe pain. As for the duration of antibiotic prescription, 201 (89%) participating practitioners prescribed antibiotics for 5–7 days, 23 participants (10%) prescribed antibiotics for <5 days, and 3 participants (1%) prescribed antibiotics for >7 days.

Of the 130 female dentists and 97 male dentists, 22 (9.7%) and 15 (6.6%) prescribed antibiotics for patients who complained of severe pain ($p = 0.77$). As for the qualifications of the dentists, 115 of the 135 general dentists...
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(50.7%) prescribed antibiotics for patients who complained of severe pain, while 75 of the 92 specialists (33%) prescribed antibiotics for patients with severe pain ($p = 0.46$). Gender and dental qualification were not significantly associated with the prescription of antibiotics ($p > 0.05$) (Fig. 1), but the independent-sample $t$ test indicated significant association between age and years of experience and antibiotic prescription for pain management, ($p = 0.04$ and 0.04, respectively) (Fig. 2).

As for antibiotic prescription in various clinical scenarios, 199 participants (87.7%) never prescribed antibiotics for reversible pulpitis with normal periapical area cases (statistically significant association with gender: $p = 0.04$), but no statistically significant difference was found between general dentists and specialists ($p = 0.69$). While 82 participants (31.6%) always prescribe antibiotics for a necrotic pulp with acute apical abscess cases, no statistically significant difference was found in relation to age and qualification ($p = 0.59$ and 0.54, respectively) (Table 1).

Amoxicillin 500 mg was prescribed most of the time ($n = 117; 51.5$%), while metronidazole 250 mg was always prescribed by 15 participants (6.6%). Metronidazole 500 mg was rarely or never prescribed by 135 (59.5%) participants, while 101 participants (45%) prescribe clindamycin 150 mg, and 38 (16.7%) never prescribe it. The majority of the participants ($n = 162; 71.4$%) never prescribed metronidazole combined with spiramycin (Fig. 3).

Regarding the use of analgesics, 93 participants (41%) prescribed diclofenac K 50 mg very often, while 89 participants (39.2%) prescribe ibuprofen (600 mg) very often. However, 148 participants (65.2%) never prescribed ibuprofen 800 mg. In addition, 136 (71.8%) participants never prescribed naproxen. Paracetamol, codeine, and caffeine were never prescribed by 104 participants (45.8%) (Fig. 4).

**Table 1. $t$ test for pulpal condition and gender, qualification, and prescription ($n = 227$)**

| Pulp Condition                  | Always | Very Often | Fairly Many Times | Occasionally | Never | $p$ value | Gender | Qualification |
|---------------------------------|--------|------------|-------------------|--------------|-------|-----------|--------|---------------|
| **Reversible pulpitis**         |        |            |                   |              |       |           |        |               |
| Normal periapical area          | 0.9%   | 2.6%       | 0.4%              | 8.4%         | 87.7% | ns        | ns     |               |
| Irreversible pulpitis           |        |            |                   |              |       |           |        |               |
| Normal periapical area          | 0.9%   | 4.8%       | 2.6%              | 9.7%         | 81.9% | ns        | 0.144  | ns            |
| Symptomatic apical periodontitis| 4.8%   | 7.5%       | 8.8%              | 24.7%        | 54.2% | ns        | ns     | 0.780         |
| **Necrotic pulp**               |        |            |                   |              |       |           |        |               |
| Normal periapical area          | 1.3%   | 5.3%       | 2.6%              | 13.2%        | 77.5% | ns        | 0.814  | 0.936         |
| Symptomatic apical periodontitis| 8.4%   | 7.9%       | 7.9%              | 29.5%        | 46.3% | ns        | ns     | 0.486         |
| Asymptomatic apical periodontitis| 2.6%   | 3.1%       | 5.7%              | 15.0%        | 73.6% | ns        | 0.871  | 0.520         |
| Acute abscess                   | 36.1%  | 18.5%      | 9.7%              | 23.8%        | 11.9% | ns        | ns     |               |
| Chronic abscess (presence of sinus tract) | 16.3% | 7.9%       | 4.4%              | 21.1%        | 50.2% | ns        | 0.265  | 0.970         |

**Discussion**

The use of antibiotics in an inappropriate manner leads to the selection of dominance of resistant microorganisms and/or the increased transfer of resistance genes from antibiotic-resistant to antibiotic-susceptible microorganisms. This rapid development of resistance has con-
tributed significantly to the morbidity and mortality of infectious diseases. The British Society for Antimicrobial Chemotherapy states that inappropriate prescription of antibacterial drugs by dental practitioners is a significant contributing factor in the selection of drug-resistant bacterial strains [26]. Improper dosing, duration of therapy, and prophylaxis are all factors that may affect the development of antibiotic-resistant microorganisms [26]. Therefore, it is important to understand the prescription pattern in Kuwait to determine whether there is a need for a possible continuous education for dentists.

In this study, 84% of the participants did not prescribe antibiotics for dental pain management. There was no statistically significant difference based on gender and qualification of dentists; our previous study reported that male dentists prescribed antibiotics for pain management significantly more frequently than female dentists [27]; this could be due to the different subjects who partici-
pated in both studies. In the current study, the questionnaires were distributed to the dentists working in the Ministry of Health, private clinics, and the Faculty of Dentistry of Kuwait University, whereas our previous study included a smaller number of participants (mainly university staff). While older participants and more experienced participants prescribed antibiotics for pain management more often than younger and less experienced participants, this could be based on anecdotal evidence from their own experience. The most commonly prescribed analgesics were diclofenac K (41%) and ibuprofen (39.2%), similar to our previous study [27]. This could be due to the dentists’ understanding of the effect of non-steroidal anti-inflammatory drugs on dental pain management as well as the availability of these medicines at low cost.

As for antibiotic prescription in medically healthy patients during routine root canal treatment procedures, 87.7% of the participants never prescribed antibiotics for reversible pulpitis, and 81.9% never prescribed antibiotics for irreversible pulpitis with normal periapical area, which is similar to the previous study [27] but less than what is reported in studies in other countries. A study conducted in Spain showed that 40% of respondents prescribed antibiotics unnecessarily for cases of irreversible pulpitis [17]. Slaus and Bottenberg [14], for example, revealed that 48% of Flemish dentists prescribed antibiotics inappropriately for acute apical periodontitis. Also, Yingling et al. [15] reported that many endodontists in the American Association of Endodontists (AAE) still prescribed antibiotics unnecessarily during endodontic treatments. Mainjot et al. [16] reported that antibiotics were often prescribed by practitioners in Belgium in the absence of fever (92.2%) and without any local treatment (54.2%).

About half of the participants prescribe amoxicillin most of the time as the first choice, followed by metronidazole (17.2%). This is in accordance with previous studies [22–25, 27]. Amoxicillin has a half-life of 1–1.5 h. A steady-state blood level would then be achieved in 3–7.5 h, thereby leading to a substantial delay in achieving therapeutic blood levels. A loading dose of double the maintenance dose is recommended for acute orofacial infections, which achieves the goal of rapid, high blood levels rather than initiating therapy with the maintenance dose. Although Augmentin (amoxicillin plus clavulanate) has higher antibacterial effectiveness, the increased costs of Augmentin led Baumgartner and Xia [28] to recommend that Augmentin be reserved for unresolved infections and patients who are immunocompromised.

It is recommended that antimicrobial agents be used on an intensive basis with vigorous dosage for as short a period of time as the clinical situation permits. Treatment duration of 3–7 days is often sufficient to control the infection, but patients should be seen after 2 or 3 days to determine whether treatment should be stopped or continued [29]. The only guide for determining the effectiveness of antibiotic therapy, and, hence, the duration of treatment, is the clinical improvement of the patient [30]. Patients on antibiotic therapy for orofacial infections should be clinically evaluated on a daily basis. When there is sufficient clinical evidence that the patient’s host defenses have regained control of the infection and that the infection is resolving or resolved, the antibiotic therapy should be terminated.

Relatively high antibiotic use suggests the need for the education of both dentists and patients about restricting the use of antibiotics to cases of severe infection. More educational initiatives to rationalize the use of antibiotics in dental practice are needed to avoid further contribution to the development of antibiotic resistance.

**Conclusion**

This study shows that most dentists in Kuwait prescribe antibiotics and analgesics when appropriate, in comparison to our previous study which showed that many dentists prescribed antibiotics for pain control and in reversible/irreversible pulpitis.

**References**

1. Keiser K, Hargreaves KM: Building effective strategies for the management of endodontic pain. Endod Top 2002;3:93–105.
2. Siqueira JF Jr, Rôças IN: Exploiting molecular methods to explore endodontic infections: part 2 – redefining the endodontic microbiota. J Endod 2004;31:488–496.
3. American Association of Endodontics: Endodontics, Colleagues for Excellence. Use and abuse of antibiotics. https://www.aae.org/specialty/wp-content/uploads/sites/2/2017/07/ecfewinter12final.pdf, 2012.
4. Parahitiyawwa NB, Jin LJ, Leung WK: Microbiology of odontogenic bacteremia: beyond endocarditis. Clin Microbiol Rev 2009;22:46–64.
5. Segura-Egea JJ, Gould K, Sen BH, et al: Antibiotics in endodontics: a review. Int Endod J 2017;50:1169–1184.
6. Poveda Roda R, Bagan JV, Sanchis Bielsa JM, et al: Antibiotic use in dental practice: A review. Med Oral Patol Oral Cir Bucal 2007;12:186–192.
7 Siqueira JF Jr, Rôças IN, Silva MG: Prevalence and clonal analysis of *Porphyromonas gingivalis* in primary endodontic infections. J Endod 2008;34:1332–1336.

8 Siqueira JF, Rôças I: Present status and future directions in endodontic microbiology. Endod Topics 2014;30:3–22.

9 Rousseau WH, Clark SJ, Newcomb BE, et al: A comparison of pain levels during pulpectomy, extractions, and restorative procedures. J Endod 2002;28:108–110.

10 Dionne RA, Campbell RA, Cooper SA, et al: Suppression of postoperative pain by preoperative administration of ibuprofen in comparison to placebo, acetaminophen, and acetaminophen plus codeine. J Clin Pharmacol 1983;23:37–43.

11 Agnihotry A, Fedorowicz Z, van Zuuren EJ, et al: Antibiotic use for irreversible pulpitis. Cochrane Database Syst Rev 2016;2:CD004969.

12 Mickel AK, Wright AP, Chogle S, et al: An analysis of current analgesic preferences for endodontic pain management. J Endod 2006;32:1146–1154.

13 Fouad AF: Are antibiotics effective for endodontic pain? Endod Topics 2002;3:52–56.

14 Slaus G, Bottenberg P: A survey of endodontic practice amongst Flemish dentists. Int Endod J 2002;35:759–767.

15 Yingling NM, Byrne BE, Hartwell GR: Antibiotic use by members of the American Association of Endodontists in the year 2000: report of a national survey. J Endod 2002;28:396–404.

16 Mainiot A, D’Hoore W, Vanheusden A: Antibiotic prescribing in dental practice in Belgium. Int Endod J 2009;42:1112–1117.

17 Segura-Egea JJ, Velasco-Ortega E, Torres-Lagares D: Pattern of antibiotic prescription in the management of endodontic infections amongst Spanish oral surgeons. Int Endod J 2010;43:342–350.

18 Jaunay T, Sambrook P, Goss A: Antibiotic prescribing practices by South Australian general dental practitioners. Aust Dent J 2000;45:179–186.

19 Cope AL, Francis NA, Wood F, et al: Antibiotic prescribing in UK general dental practice: a cross-sectional study. Community Dent Oral Epidemiol 2016;44:145–153.

20 Cope AL, Barnes E, Howells EP, et al: Antimicrobial prescribing by dentists in Wales, UK: findings of the first cycle of a clinical audit. Br Dent J 2016;8:221:25–30.

21 Ford PJ, Saladine C, Zhang K, et al: Prescribing patterns of dental practitioners in Australia from 2001 to 2012. Antimicrobials. Aust Dent J 2017;62:52–57.

22 Alattas HA, Alyami SH: Prescription of antibiotics for pulpal and periapical pathology among dentists in southern Saudi Arabia. J Glob Antimicrob Resist 2017;25:9:82–84.

23 American Dental Association Council on Scientific Affairs: Combating antibiotic resistance. J Am Dent Assoc 2004;135:484–487.

24 Abbott PV, Hume WR, Pearman JW: Antibiotics and endodontics. Aust Dent J 1990;35:50–60.

25 Abbott PV: Selective and intelligent use of antibiotics in endodontics. Aust Endod J 2000;26:30–39.

26 Sweeney LC, Jayshree D, Chambers PA, et al: Antibiotic resistance in general dental practice – a cause for concern. J Antimicrob Chemother 2004;53:567.

27 Al-Maslamani M, Sedeqi F, Moule A: Prescription pattern of antibiotic and analgesic in endodontic treatment in Kuwaiti population: a self-administered survey. Saudi Endod J 2014;4:128–134.

28 Baumgartner JC, Xia T: Antibiotic susceptibility of bacteria associated with endodontic abscesses. J Endod 2003;29:44–47.

29 Dar-Odeh NS, Abu-Hammad OA, Al-Omiri MK: Antibiotic prescribing practices by dentists: a review. Ther Clin Risk Manag 2010;6:301–306.

30 Hessen MT, Kaye D: Principles of selection and use of antimicrobial agents. Infect Dis Clin North Am 1989;3:479.