

RESEARCH ARTICLE

Assessment of Prescription Patterns and Appropriateness of Antibiotics for Prophylaxis in Dental Procedures: A Retrospective Study

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ABSTRACT

There is a lack of data on dentists' prescribing behaviors when it comes to the correct use of antibiotics in dental treatments. Antibiotic prescriptions made by dentists were analyzed from a diagnostic perspective in a countrywide study. This study retrospectively examined national health data from January 2018 through August 2019, collected through the Prescription Information System. The analysis only included prescriptions for a single illness and at least one systemic antibiotic. Antibiotic prescribing practices and the role of dental specialization and diagnosis were studied. A total of 9,214,956 prescriptions out of 9,293,410 matched the criteria for inclusion. An average course of antibiotic treatment consists of 1.01 pills. Antibiotics were prescribed most frequently for dental caries (16.2% of cases), dental examinations (20.7% of cases), and periapical abscess without sinuses (28.1% of cases). Antibiotics were prescribed for 96.6% of patients for illogical or confusing reasons, whereas just 3.4% were given based on a single, unambiguous diagnosis, such as cellulitis or a mouth abscess. The most commonly prescribed treatment for any medical issue was amoxicillin combined with an enzyme inhibitor (58.6%). Compared to unidentified dental practitioners (58.2%; $p = 0.0001$), dental specialists in Groups A and B significantly overprescribed amoxicillin plus an enzyme inhibitor (67.0 and 67.8%, respectively; $p = 0.0001$) (data not shown). The results of the study suggest that dentists routinely and arbitrarily prescribe antibiotics with questionable rationale in the contexts studied. These results emphasize the need for dentists to begin prescribing antibiotics more deliberately and evidence-based. Educational programs, awareness campaigns, and antibiotic stewardship programmes are just some of the interventions that may be implemented to improve prescribing practices and ensure the correct use of antibiotics in dental operations. The results of this countrywide study highlight problems with dentists' procedures for prescribing dental antibiotics. The paper states that dentists should base their prescription practices on sound reasoning and empirical data. Dentists can help with global efforts to lower antibiotic resistance and improve patient care if they prescribe them in a more reasonable and responsible manner.

Keywords: Antibiotic prescribing, Dental indications, Dental procedures, Dentistry.

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INTRODUCTION

In patients who are already susceptible to infective endocarditis and other systemic complications due to preexisting cardiac conditions, antibiotic prophylaxis serves a crucial role in preventing bacterial infections associated with dental treatments. However misusing or overusing antibiotics can cause unwanted side effects, promote antibiotic-resistant bacteria, and drive up medical costs. Antibiotics may be prescribed as prophylactic measures prior to dental procedures by reviewing prescription records to ensure the best possible patient care and minimize the risks associated with antibiotic abuse.

Previous studies in dentistry have revealed inappropriate antibiotic use and variations in prescription patterns,

highlighting the need for in-depth evaluation and correction. In order to improve prescription practices, it is important to identify the factors that influence prescription rates, and to ascertain whether or not antibiotic prophylaxis is warranted.

Dentists write one out of every 10 prescriptions for antibiotics in the United States.¹ Over 60% of all antibiotic prescriptions written by dentists are filled by patients enrolled in Medicare Part D.² Dental prescriptions have remained stable despite national cutbacks in antibiotic prescribing.³ This is true even though revisions in clinical recommendations have condensed the justifications for antibiotic prophylaxis prior to dental treatments.⁴

Patients with certain disorders, such as those who have recently had prosthetic joint implants, were previously advised to take antibiotic prophylaxis prior to dental visits.

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Prophylaxis was recommended for these patients because bacteremia established during dental treatment increased their chance of developing life-threatening distant site infections (including infective endocarditis and prosthetic joint infections). However, recommendations for using antibiotics to prevent infective endocarditis and infections of prosthetic joints were updated in 2007 and 2013, respectively.⁵ Reasons for the shift include the potential for antibiotic-related adverse effects and the absence of evidence linking endocarditis to joint infections, dental care, or dental care.⁶ The potential for adverse outcomes, such as antibiotic resistance and *Clostridioides difficile* infection, much exceed any purported advantages.⁷ Therefore, individuals with heart issues who are at the highest risk for adverse outcomes from infective endocarditis should only take antibiotics before undergoing invasive dental procedures.^{8,9}

Even though research has indicated that thirty percent of antibiotics prescribed to outpatients in primary care settings are unnecessary,¹⁰ no study has looked at whether dentists should be prescribing antibiotics. Therefore, the goal of this study was to determine whether or not antibiotic prophylactic dental operations are effective.

MATERIALS AND METHODS

Based on dentists' prescription data retrieved from the All India Database Records (AIDDR) database, this retrospective analysis concentrated on systemic antibiotics for dental disorders. Prescriptions with a single diagnosis as well as at least one systemic antibiotic, were analysed in detail for this investigation to demonstrate causality. Anatomical therapeutic chemical (ATC) categorization was utilized, which was given by the World Health Organisation (WHO). The International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) was used to categorize antibiotics.

At the ATC-5 level, the distribution of the top 10 most often given antibiotics for the top ten dental conditions was investigated. Antibiotic prescription rates were also compared between general dental caries and pulp and periapical tissue disorders. The study also evaluated the suitability of eleven dental diagnoses for antibiotic prescriptions, distinguishing between rational and illogical/uncertain indications. Rational indications covered circumstances in which systemic antibiotherapy was unquestionably necessary.

The evaluation of the antibiotics prescribed by three different subgroups of dentists was also a part of the analysis: Group A specialists, who primarily perform invasive surgical procedures, Group B specialists, who primarily perform less invasive surgical procedures, and Group C dentists, which included other dental professionals. The study compared alternative antibiotics to the most often prescribed antibiotic for each condition among these dental groups.

Software called SPSS 11.5 was used to do the statistical analysis. Visualizations of quantitative results included frequency tables and graphs. The Chi-square test was used to establish statistical significance, and a p-value of less than 0.05 was considered significant.

RESULTS

After looking at 9,214,956 prescriptions with a single diagnosis and at least one medicine, 9,293,410 antibiotics were discovered. A total of 87% of all antibiotic prescriptions included more than one medication for a single condition. On average, doctors prescribe 1.01 courses of antibiotics each patient. Most dentists (28.1%) prescribe antibiotics to treat periapical abscesses without sinus infection, followed by dental evaluation (20.7%) and dental caries (16.2%). Cellulitis with abscess of the mouth, which was ranked eighth on the list, is the only ailment in the top 10 for which there is unquestionable justification for the use of antibiotics. Amoxicillin with an enzyme inhibitor was the most often prescribed antibiotic for these diagnoses (58.6%), followed by spiramycin (9.8%) as well as amoxicillin (9.2%). Table 1 demonstrates this. Amoxicillin and an enzyme inhibitor were the most common treatments for acute apical periodontitis originating in the pulp (63.5%). The Online Resource provides information regarding the total number of antibiotic treatments that were provided for the two primary subgroups of dental caries, namely illnesses affecting the pulp and periapical tissues.

This retrospective study's examination of diagnosis for justifiable antibiotic indications produced some interesting results. Only 3.4% of the antibiotics prescribed were for cellulitis and mouth abscesses, with the remaining 96.6% being prescribed for illogical or unclear explanations. When the antibiotic groups were differentiated based on reasonable versus illogical/uncertain indications, statistically significant differences were found ($p < 0.0001$). Cellulitis and oral abscesses were among the conditions for which antibiotics like spiramycin, amoxicillin, cefalexin, fusidic acid, and cefaclor were recommended far less often than for other conditions. Cellulitis and oral abscesses were less likely to be treated with amoxicillin, cefalexin, fusidic acid, as well as cefaclor, but dental caries was the clear winner (Figure 1).

Only 1.2% of group A specialists ($n = 151$) and 1.1% of group B specialists ($n = 306$) prescribed antibiotics, whereas 97.7% of Group C dentists ($n = 7884$) did so. When antibiotic prescriptions were analyzed, it became clear that there were significant differences across the three primary categories of dentists. The most frequent prescription reason for both specialized groups was dental inspection, while the most frequent reason for nameless dental practitioners was periapical abscesses without sinus. None of the three dental groups listed cellulitis or oral abscess among the top five reasons for prescribing antibiotics. Among the top five dental diagnoses, amoxicillin with an enzyme inhibitor was always the first-choice antibiotic. The most commonly prescribed combination of amoxicillin and an enzyme inhibitor was found to be significantly more often prescribed by dentists in groups A and B (67.0 as well as 67.8%, respectively) than by dentists in Group C (58.2%, $p 0.0001$) (Figure 2).

These findings highlight the existence of erroneous and ambiguous antibiotic indications in dentistry practice. There is a need for standardized guidelines and protocols to support prescribing supported by evidence, as seen by the differences

Table 1: The distributions of antibiotics at the ATC-5 level in terms of the mostly encountered dental diagnoses

Antibiotics	Periapical abscess without sinus (%)	Dental examination (%)	Dental caries (%)	Other dental caries (%)	Dental caries–unspecified (%)	Pulpitis (%)	Cellulitis and abscess of mouth (%)	Caries of dentine (%)	Periapical abscess with sinus (%)	Acute apical periodontitis of pulpal origin (%)	Total % (n)
Amoxicillin + enzyme inhibitors	58.7	55.6	58.9	59.7	61.5	60.7	59.7	57.8	60.3	63.5	58.6 (5,447,158)
Spiramycin	9.3	12.1	9.9	9.5	4.8	8.8	9.3	11.5	9.4	8.1	9.8 (910,946)
Amoxicillin	9.2	9.9	9.5	9.3	9	8.3	7	9.5	8	7.2	9.2 (858,758)
Cefalexin	5.9	5.9	4.4	5.1	5.1	5.2	4.2	4.8	5.4	3.2	5.3 (494,810)
Sultamicillin	3.7	3.5	3.2	3.8	1.6	3.2	4.6	3	2.7	3.8	3.5 (321,341)
Fusidic acid	2.3	1.9	1.4	1.8	2.4	2.2	1.2	2	1.4	2.5	1.9 (178,107)
Clindamycin	2.1	1.4	1.7	1.3	1.8	1.7	2.1	1.5	2.1	1.3	1.7 (157,703)
Cefuroxime	1.9	2.3	2.7	2.2	1.5	2.5	4.1	2.7	1.9	3.7	2.3 (216,591)
Cefaclor	1.8	2.7	2.8	2	4.6	3.3	2	1.9	2.3	1.9	2.4 (220,544)
Cefprozil (cefazolin) ^a	1.2	0.9a	1.7	1.4	4.2	1	1.9	1.6	1.9	1.2	1.5 (134,350)
Others	3.9	3.8	3.8	3.9	3.5	3.1	3.9	3.7	4.6	3.6	3.8 (353,102)
Total % (n)	100 (2,615,160)	100 (1,924,139)	100 (1,508,950)	100 (1,413,214)	100-464,219	100-391,677	100-313,369	100-272,854	100-206,848	100-182,98	100 (9,293,410)
Rank of top 10 diagnosis (%) ^b	1 (28.1)	2 (20.7)	3 (16.3)	4 (15.2)	5 (5.0)	6 (4.2)	7 (3.4)	8 (2.9)	9 (2.2)	10 (2.0)	-100

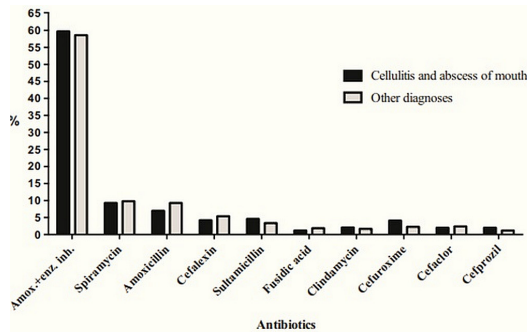


Figure 1: Cellulitis and oral abscesses are much more likely to result in an antibiotic prescription than other illnesses (p = 0.0001).

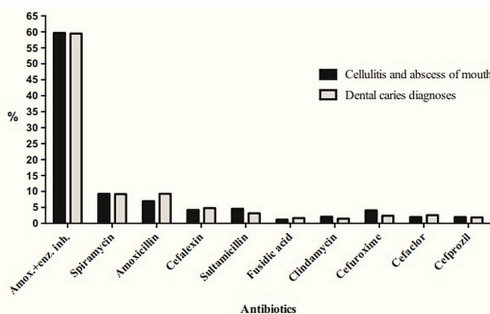


Figure 2: Cellulitis, oral abscess, and dental caries all had significantly higher rates of antibiotic prescription (p 0.05, excluding spiramycin and cefprozil). Amoxicillin with an enzyme inhibitor is abbreviated as Amox. + enz.inh.

in prescription patterns among various dentists. For prescribing practices to be in line with the right indications and for antibiotic use in dental treatments to be optimized, improved

knowledge, education, and implementation of antibiotic stewardship programmes are essential.

DISCUSSION

The results of this study shed light on prescription trends and the need for prophylactic antibiotic use in dental treatments. Some alarming tendencies and variances in antibiotic prescribing practises were discovered after analysis of a sizable dataset of 9,214,956 prescriptions.

A 9,293,410 distinct antibiotics were found by the study, demonstrating the enormous variety of options available to dentists for prophylactic usage. But it's crucial to think about whether such a wide range of antibiotic alternatives is required and whether it promotes the prudent use of antibiotics.

A 87.7% of prescriptions for antibiotics were connected to a single diagnosis as well as at least one medication. This implies that the majority of dentists follow the practise of writing prescriptions for specific antibiotic indications, which is a benefit of the study. To ensure that prescribing is reasonable, assessing whether using antibiotics for certain indications is appropriate is essential.

Periapical abscess without sinus was the most common reason for antibiotic prescriptions, followed by dental examination and dental caries. The only diagnosis among the top 10 for which the use of antibiotics is without a doubt justified is cellulitis with abscess of the mouth, which came in at number eight on the list. From the perspective of antibiotic stewardship, this raises questions about potential overuse or inappropriate use of antibiotics for specific diseases.

The most often recommended antibiotic across a range of diseases was amoxicillin plus an enzyme inhibitor, followed

by spiramycin and amoxicillin. Although the combination of amoxicillin and an enzyme inhibitor may be suitable for some purposes, its widespread use raises concerns regarding the justification for such prescribing practices and the possibility of the evolution of antibiotic resistance.

Only a small percentage (3.4%) of antibiotics were administered for cellulitis and oral abscesses, which are circumstances where antibiotic use is appropriate. This was found by the review of diagnoses for rational antibiotic indication. The remainder (96.6%) were given for illogical or unclear reasons, demonstrating a substantial need for improvement in antibiotic prescribing practices.

When antibiotic groups were divided into those with rational vs illogical/uncertain indications, there were significant disparities between the groups. Antibiotics such as spiramycin, amoxicillin, cefalexin, fusidic acid, and cefaclor were more frequently administered for diagnoses other than cellulitis and oral abscess. Similarly, dental caries were more likely to be treated with amoxicillin, cefalexin, fusidic acid, and cefaclor than cellulitis and oral abscess. These findings underline the necessity of coordinating antibiotic prescribing practices with proper indications and evidence-based recommendations.

The study investigated variations in antibiotic prescription practices among various dental professional groups. The most frequent reason for prescription among specialized groups was dental inspection, while the most frequent reason among unidentified dental practitioners was periapical abscess without sinus. Cellulitis and oral abscess were not among the top five reasons for prescribing antibiotics in any of the three dentist groups, raising concerns about possible gaps in the use of antibiotics for these illnesses.

All dental groups preferred amoxicillin plus an enzyme inhibitor, with higher prescription rates among specialised groups when compared to general dental practitioners. These results imply that more work may be required to enhance general dental practitioners' prescription of antibiotics.

CONCLUSION

Our research shows that dentists frequently prescribe antibiotics in a needless fashion that is frequently at odds with evidence-based medicine. Their selection of antibiotics for the mentioned circumstances could be considered unreasonable. For dentists to use antibiotic dissemination activities rationally, antibiotic overprescribing for undiagnosed conditions must be considered. It is acknowledged that a significant proportion of dentists engaged in illogical, or at the very least inattentive, behavior while giving the diagnosis, but this was more noticeable in experts. These findings point to the urgent need for dentists to adopt more sensible pharmacological practices, particularly when prescribing antibiotics.

This study emphasizes the value of a reasonable prophylactic antibiotic prescription in dental treatments. The results highlight the necessity of uniform rules and practices to guarantee appropriate antibiotic usage, particularly for diagnoses when antibiotic treatment is obviously required.

In order to promote evidence-based practices and decrease needless antibiotic prescriptions in dental settings, educational activities aimed at dentists as well as efficient antibiotic stewardship programmes might be very helpful.

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