

Antibiotic Abuse in Dentistry: A Considering Issue for Antibiotic Resistance: Systemic Review

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Abstract

Background: Infections caused by antibiotic resistance pose a serious global health threat, undermining our ability to treat common infections and deliver complex medical procedures. Antibiotic misuse, particularly in low-middle-income countries, is accelerating this problem.

Aim of Study: The aim of this systematic review was to investigate the use of antibiotics and antibiotic resistance in dentistry.

Patients and Methods: A systematic search was performed in PubMed, Google Scholar, Embase, the Cochrane library, and Web of Science, for studies that investigated the use of antibiotics and antibiotic resistance in dentistry. After extracting data, the pooled sensitivity, specificity, constructed summary receiver operating characteristics curve and positive likelihood ratio were estimated. 1436 abstracts were reviewed after duplication removal and subsequently the full text of the 110 articles was obtained according to the inclusion criteria. A total of 99 studies were excluded.

Results: 12 studies were considered eligible after full-text review. The results revealed that there was significant improvement in homogeneity in subgroups classified by state, *p*-value, imaging techniques, and other factors ($\text{Chi}^2=148.60$, $p<0.00001$, $I^2=93$).

Conclusions: The misuse of antibiotics contributes to the development of bacterial resistance. A proper use of antibiotics in treatment of dental, dental infections play a critical role in avoiding the emergence and transmission of resistance, and all healthcare personnel must be aware of this.

Key Words: Antimicrobial resistance – Antibiotic resistance – Antibiotic overuse – Inappropriate prescription – Self-medication – Dentistry – Meta-analysis.

Introduction

INFECTIOUS disorders contributed to high mortality and morbidity rates over the world, hence antibiotics are regarded as one of the greatest inventions of the twentieth century [1]. Antibiotics

are an important aspect of dentistry, and prescription antibiotics is a privilege that should be used with caution [2]. Dentists, on the other hand, have been accused of abusing antibiotics all over the world

Antibiotics are also the most commonly prescribed medications in poor countries. Except for opioids and a few tranquillizers, legal prescriptions are not always required for purchasing pharmaceuticals, and in most circumstances, medicines, including antibiotics, can be purchased without one

Antibiotics cause a wide range of adverse medication responses, from moderate and reversible to severe and lethal [5]. Antibiotics can disturb a person's good flora, leading to life-threatening opportunistic bacterial infections such *Clostridium difficile* [6]. Since the appearance of multidrug-resistant bacterial strains, which are highly resistant to many antibiotic classes [8], antibiotic resistance has been determined to be one of the world's most pressing public health issues [7]. As a result, antibiotic resistance has been determined to be one of the world's most pressing public health issues [4].

Longer-lasting sickness, more medical visits, longer hospital admissions, the need for more expensive medications, and even death [4] may be the outcome of this resistance. Antibiotic abuse could be caused by prescribers' lack of expertise, patients' desire, and a lack of patient awareness spread by health care providers and negative attitude and practice pattern [9].

Antimicrobial-resistant pathogens kill at least 700,000 people every year, and if allowed unchecked, they might kill 10 million people by 2050, resulting in a loss of 100 trillion dollars to the global economy and a 2-3.5 percent decline in

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global GDP [10]. As a result, they pose a severe global health danger, making it difficult to treat common infections and perform complex medical procedures [11].

The widespread use of antimicrobials has hastened the evolution of resistance in bacteria, which is a natural evolutionary process [12]. There is a definite correlation between antimicrobial use and the development of antimicrobial resistance, according to the evidence [13].

Antibiotic resistance is a type of antimicrobial resistance (AMR) that refers to bacteria's ability to survive in the presence of antibiotics that are meant to kill or stop them from proliferating. The misuse and/or overuse of antibiotics facilitates and accelerates this sort of resistance [14].

The problem is made worse when inappropriate usage occurs, for example when antibiotics can be bought over the counter without a prescription and/or where they are prescribed inappropriately by healthcare providers due to a lack of standard treatment guidelines.

The aim of this systematic review was to investigate the use of antibiotics and antibiotic resistance in dentistry.

Patients and Methods

The related studies were found using a systematic search in PubMed, Google Scholar, Embase, the Cochrane library, and Web of Science. The following search string combinations were used: (antibiotics) and (antibiotics resistance) and (dentistry).

Study selection:

The search strategy identified 1226 studies, and after the removal of duplicates and title and abstract screening process, 96 studies were retrieved. Full-text analysis was performed for these 110 studies were considered as being eligible for inclusion in our review. 12 studies involved quantitative research and reported the number and percentages of antibiotic prescriptions and indications for use and assessed the perception of prescribers about drivers of antibiotic resistance in dentistry. A total of 12 studies were included for analysis. In addition, the reference list of these 12 studies was reviewed.

Statistical analysis:

True-positive, false-positive, false-negative, and true-negative results were extracted from each study before data pooling, and the sensitivity,

specificity, positive likelihood ratio (PLR), negative likelihood ratio (NLR), and corresponding 95 percent confidence intervals (95 percent CIs) were calculated. The sensitivity, specificity, PLR, and NLR were summarised using the bivariate random-effects model.

Results

There were 1436 potential article citations in the preliminary literature review (Fig. 1). 1226 of these studies were immediately excluded because they were irrelevant, or were published in languages other than English according to the exclusion criteria. The full text of the remaining 110 articles was downloaded for a more thorough examination. Following the full-text reading, 99 articles were eliminated. Eventually, 12 previously published papers were chosen based on the inclusion and exclusion criteria of the present study.

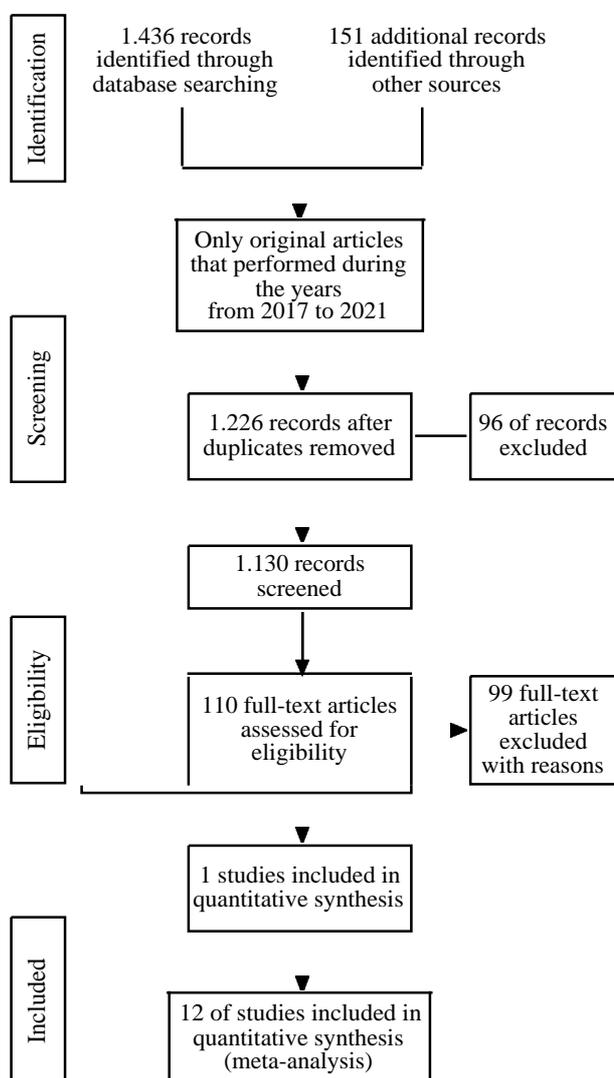


Fig. (1): Flow chart for the identification of the articles included in the meta-analysis.

Table (1): Characteristics of included randomized controlled trials.

Author	Year	Country	No. of patient	Type of study	Aim	Conclusion
1- Stein et al., [15]	2018	Canada	Unknown	Review	To describe antibiotic prescribing behaviors in dentistry, including clinical and nonclinical indications for their use, the type and regimen of antibiotics prescribed, and factors influencing their prescription, the authors conducted a scoping review.	Considering the seriousness of antibiotic resistance, the authors highlight trends in antibiotic prescribing practices, characterize factors contributing to the use and misuse of antibiotics in dentistry, provide insight into the importance of antibiotic stewardship in the oral health setting, and encourage dentists to reflect on their antibiotic prescription practices.
2. Aidasani B. et al., [16]	2019	India	Unknown	Review	The use of antibiotics by health care professionals.	Insufficient literature support necessitates.
3. Rodríguez Sánchez et al., [17]	2019	Italy	160	Cross-sectional	The main objective of this study was to assess the current antibiotic prescribing habits of dentist in conjunction with oral implant surgery in Italy. The secondary objective was to assess the nature and amount (mg) of antibiotics prescriptions in order to evaluate whether any consensus has been reached and if the current recommendations are complied.	Dentists in Italy on a large scale prescribe antibiotic prophylaxis in conjunction with oral implant surgery among healthy patients. A high range of prophylactic regimens is prescribed and they are not adhering to the new science-based specifications. Guidelines focused on the indications for prophylactic antibiotics among healthy patients are required to prevent bacterial resistance, side effects and costs caused by over treatment and the irrational use of antibiotics.
4. Bhuvanaraghan et al., [18]	2021	India	Unknown	Review	The aim of this systematic review was to investigate the use and misuse of antibiotics in dentistry.	Antibiotic misuse in dentistry is a serious global threat, with inappropriate use.
5. El-Geleel, et al., [19]	2021	EGYPT	500	Cross-sectional survey	The purpose of this survey is to investigate the knowledge, attitudes and practices of antibiotic Prescription.	Although the participants showed considerably adequate knowledge of the bacterial resistance problem, their practices showed varying degrees of deviation from the guidelines of antibiotic prescriptions set by the AAPD.
6. Bansal et al., [20]	2019	India	Unknown	Review	The aim of this systematic review was to discuss antibiotic abuse.	Antibiotic resistance is a multifaceted problem and its containment requires a holistic approach. Endodontists should stop injudicious use of antibiotics.
7. Guerrini et al., [21]	2019	Italy	Unknown	Review	The aim of this work is to investigate the clinical situations which require the administration of antibiotics in dentistry.	Dentists, together with the General Practitioners and Paediatricians, should be cautious and accurate and should administer antibiotics only if recommended by guidelines and effective and safe.

Table (1): Count.

Author	Year	Country	No. of patient	Type of study	Aim	Conclusion
8- Fayisa, [22]	2019	India	2802	Retrospective	Aims to evaluate factors related to the prescribing, dispensing, administering and taking of medication, and its associated events. Antibiotic prescription by dental practitioners has an important impact on the rate of general antibiotic prescription use, and an attempt has been made to establish a surveillance system for the monitoring and control of the use of these drugs.	The study was conducted to analyze the drug utilization pattern in outpatient department at dental hospital. Most of prescription were rational, both monotherapy and polypharmacy were practiced. Safer drug with less adverse effect profile were considered. Among the antibiotic amoxicillin was the commonest.
9- Khare et al., [23]	2019	India	1273	Cross-sectional	The aim of this study is to determine the practices and seasonal changes in antibiotic prescribing for common illnesses by IHCPs.	The study concludes that antibiotics were the more commonly prescribed drugs compared to other medications for common illnesses, most of which are broad-spectrum antibiotics, a situation that warrants further investigations followed by immediate and coordinated efforts to reduce unnecessary antibiotic prescriptions by IHCPs.
10- Haque et al., [24]	2019	Italy	Unknown	Retrospective	The aim of this review is to evaluate the use of antibiotics in dental diseases. Almost certainly the promotion of primary oral health care (POHC) in primary health care program especially among the least and middle-income countries (LMIC) may be the answer to ensure and promote rational dental care.	Antimicrobial resistance is a natural phenomenon that occurs as microbes evolve. However, resistance. Incorrect and inappropriate use of antibiotics are contributing to the development of such resistance.
11- Roberts et al., [25]	2019	United States	24.5 million	Retrospective	Aim of the work was to be consistent with non-research program evaluation and monitoring by the Human Subjects. Advisor in the National Center for Emerging and Zoonotic Infectious Diseases, and thus Institutional Review Board (IRB) review was not required.	It is necessary that all healthcare workers must recognize dental infections play a central role in preventing the emergence and spread of resistance.
12- GBD 2017 Oral Disorders Collaborators et al., [26]	2020	United States	532 million	Retrospective	In order to inform policy planning and evaluation efforts. This GBD study report presents data on the prevalence, incidence, and disability adjusted life-years (DALYs) associated with oral conditions from 1990 to 2017, by sex, age, and country.	The findings highlight the continued public health challenge posed by oral health conditions: unmet demand for dental services approaches 3.5 billion cases. Low- and middle-income countries with large populations have the largest normative demand for dental services. Implications for policy include incorporating dental care into universal health coverage programs, with a potential role of minimally invasive dentistry. Prevention of new cases of dental disease is a critical priority. The GBD 2017 data help to localize inequalities in the distribution of the burden of oral health problems around the world.

Raw data of 566, 504, 735 patients were extracted from 12 clinical trials selected from 1,226 articles. The mean duration time of neuropathic pain was more than one months. Studies included focal neuropathic pain, generalized pain like fibromyalgia. Our results demonstrated that the antibiotic resistance in dentistry was statistically significant ($p < 0.0001$).

Use if tissucol provides a lower incidence of postoperative neuralgia and earlier resumption of daily activities, analgesic impact with pain improvement according to the mean percent reduction in pain analog.

As shown in Fig. (2): Quality assessment of the included studies was done using the Quality Assessment of Diagnostic Accuracy Studies. The red bar indicates high risk of bias; the yellow bar indicates unclear risk of bias; and the green bar indicates low risk of bias. In the lower part, details of quality assessment were shown. Green circle with '+' indicates low risk of bias or low concern for applicability; yellow circle with '?' indicates unclear risk of bias or unclear concern for applicability; red circle with '-' indicates high risk of bias or low concern for applicability.

As shown in Figs. (3,4): Forest plot of the pooled sensitivity and specificity for the included studies. Black solid horizontal lines indicate 95% CIs of each individual studies. Dashed line indicates the pooled sensitivity or specificity for all 12 studies. The grey boxes with central blue dots indicate the sensitivity or specificity for each individual study.

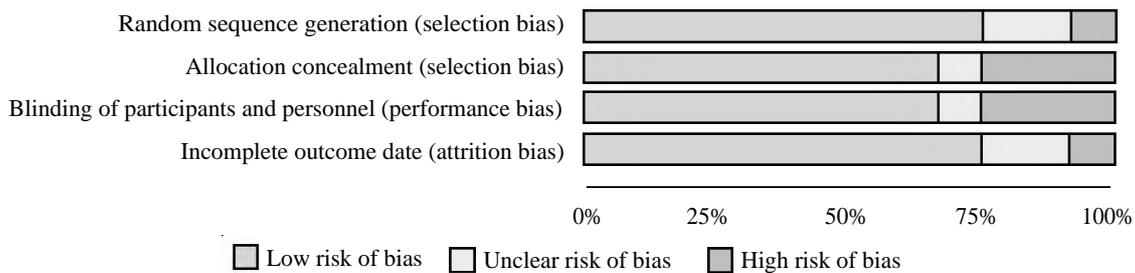
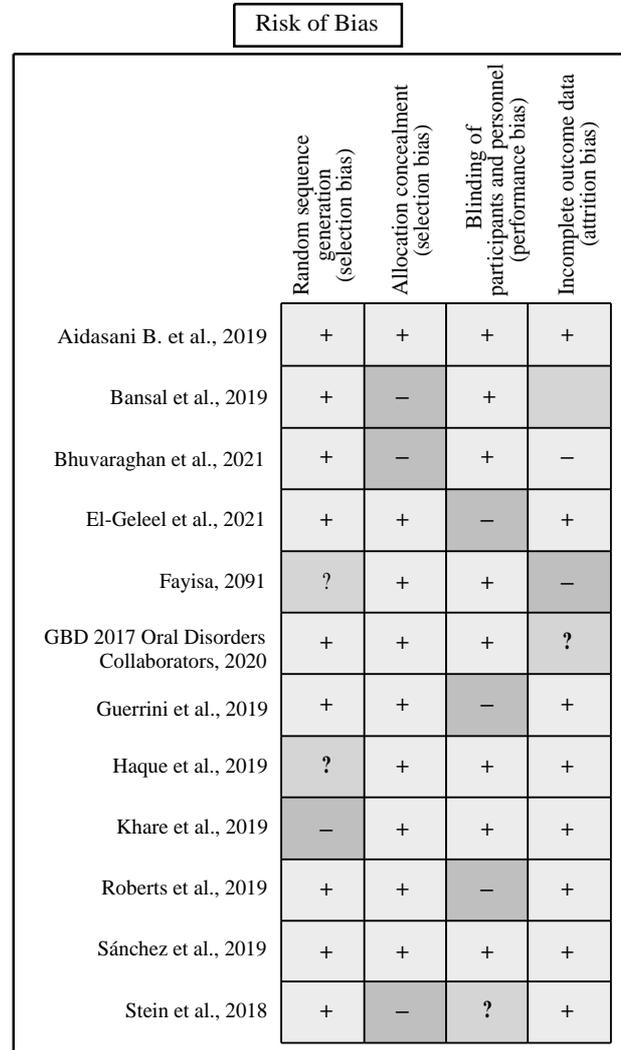


Fig. (2): Risk of bias summary: Review authors' judgements about each risk of bias item for each included study.

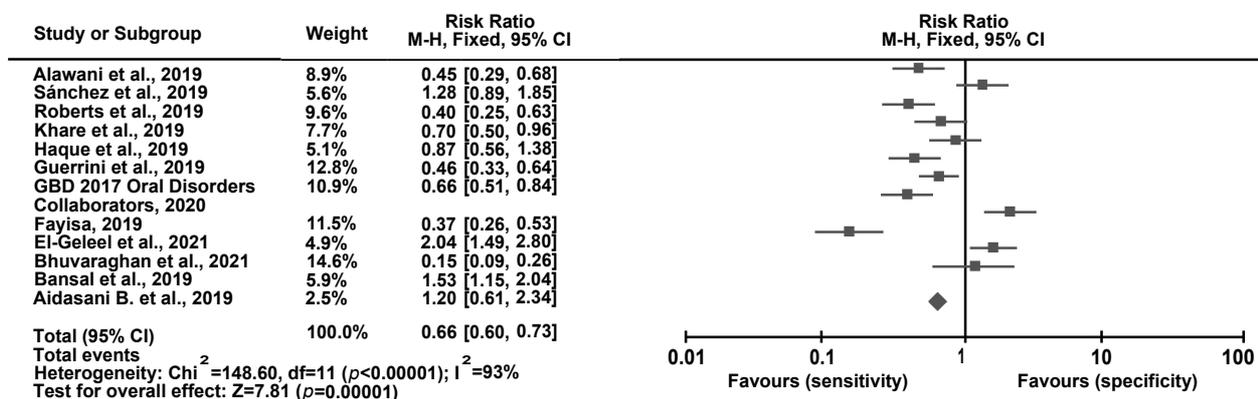


Fig. (3): Forest plot of comparison.

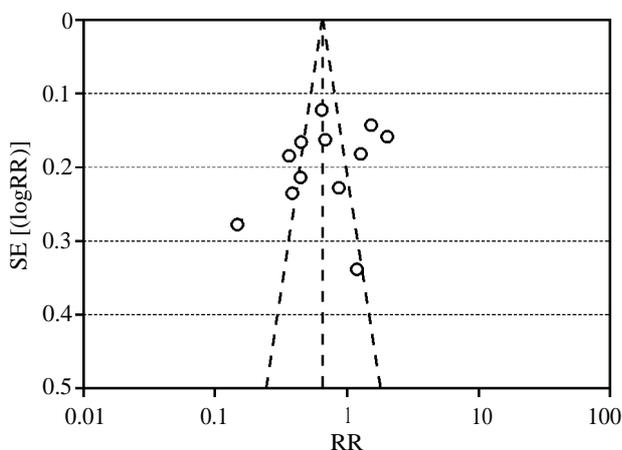


Fig. (4): Funnel plot is used to visually inspect data for publication bias. The symmetrical inverted funnel shape suggests that there is no publication bias. Deeks' funnel plot for assessment of publication bias. Potential publication exists if the calculated $p < 0.05$.

Discussion

Antibiotic resistance has become a major global issue, with increased morbidity and mortality, as well as significant issues in terms of healthcare delivery and costs. Antibiotic resistance genes (ARGs) are found in all microbial communities (microbiomes), and the resistome is a collection of ARGs. Beyond the seemingly basic interactions between drugs and bacteria, advances in genome sequencing techniques are providing a deeper knowledge of antibiotic resistance. The resistome's growing understanding is driving new antibiotic resistance methods, such as new treatments and antimicrobial stewardship programs [27].

In the present meta-analysis, 75% of the studies were of low risk of bias regarding the random sequence generation (selection bias), while more than 50% of the studies were of low risk of bias regarding the allocation concealment (selection bias) [16,17,19,21-26], blinding of outcome assessment [16,17,18,20,22,23,24,26], and incomplete outcome data (attrition bias) [16,17,19,21,23,24,25].

Regarding the heterogeneity between studies, the 12 included studies demonstrated significant heterogeneity with $p < 0.00001$ using X^2 test. In addition, there was threshold effect found (correlation, 7.81; proportion of heterogeneity due to threshold effect, (37.81), ($p = 0.0001$).

Raw data of 566, 504, 735 patients were extracted from 12 clinical trials selected from 1,226 articles. The mean duration time of neuropathic pain was more than one months. Studies included focal neuropathic pain, generalized pain like fibro-

myalgia. Our results demonstrated that the antibiotic resistance in dentistry was statistically significant ($p < 0.0001$).

Conclusion:

Antibiotics were the most commonly prescribed drugs compared to other medications for common illnesses, dentists should prescribe antibiotics according to guidelines. Antimicrobial resistance is an important phenomenon in the growth of microorganisms. The misuse of antibiotics contributes to the development of resistance. Dental infections play a critical role in avoiding the emergence and transmission of resistance, and all healthcare personnel must be aware of this.

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تعاطى المضادات الحيوية فى طب الأسنان : النظر فى قضية مقاومة المضادات الحيوية

خلفية الدراسة: تشكل العدوى التى تسببها مقاومة المضادات الحيوية تهديداً خطيراً للصحة العالمية، مما يقوض قدرتنا على علاج العدوى الشائعة وتقديم إجراءات طبية معقدة. إن إساءة استخدام المضادات الحيوية، لا سيما فى البلدان ذات الدخل المتوسط والمنخفض، يؤدى إلى تسريع هذه المشكلة.

الهدف من الدراسة: المراجعة المنهجية هو تقصى استخدام المضادات الحيوية ومقاومة المضادات الحيوية فى طب الأسنان.

منهجية الدراسة: تم إجراء بحث منهجى فى PubMed و Google Scholar و Embase ومكتبة Cochrane و Science Web of للدراسات التى بحثت فى استخدام المضادات الحيوية ومقاومة المضادات الحيوية فى طب الأسنان. بعد استخراج البيانات، تم تقدير الحساسية المجمعّة والنوعية ومنحنى خصائص تشغيل مستقبل الملخص المنشأ ونسبة الاحتمالية الإيجابية. تمت مراجعة ١٤٣٦ ملخصاً بعد إزالة التكرار، وبالتالي تم الحصول على النص الكامل للمقالات ١١٠ وفقاً لمعايير التضمين. تم استبعاد ما مجموعه ٩٩ دراسة.

نتائج الدراسة: تم اعتبار ١٢ دراسة مؤهلة بعد مراجعة النص الكامل. أظهرت النتائج أن هناك تحسناً ملحوظاً فى التجانس فى المجموعات الفرعية المصنفة حسب الحالة والقيمة الاحتمالية وتقنيات التصوير وعوامل أخرى ($ChI^2=148.60, p<0.00001, I^2=93$).

الاستنتاجات: سوء استخدام المضادات الحيوية يساهم فى تطوير المقاومة البكتيرية. يلعب الاستخدام السليم للمضادات الحيوية فى علاج التهابات الأسنان، دوراً مهماً فى تجنب ظهور المقاومة وانتقالها، ويجب أن يكون جميع العاملين فى الرعاية الصحية على دراية بذلك.