

## RESEARCH ARTICLE

# The Global Impact on Health of Dental Infections and Antibiotic Resistance: A Mini Review

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## Abstract

Dental abscesses are a common infectious process that medical professionals are aware of. The aggressiveness of the bacteria, host resistance mechanisms, and local anatomy all influence how the infection turns out. A dental abscess that spreads can have serious implications that result in a high rate of morbidity and death. Acute dental abscesses are composed of a variety of microorganisms, including facultative anaerobes like *Streptococcus anginosus* group and *viridans* group streptococci, as well as stringent anaerobes such anaerobic cocci, *Prevotella*, and *Fusobacterium* species.

Antibiotics are commonly prescribed to treat dental infections. The benefits of antibiotics are that they can help resolve symptoms quickly, reduce pain, and prevent systemic infections. However, antibiotics can also have negative impacts on health, such as promoting antibiotic resistance. Antibiotic resistance refers to the phenomenon where bacteria evolve to become immune to antibiotics, making them harder to treat. Bacteria can develop resistance through mutations or by acquiring resistance genes from other bacteria.

The overuse and misuse of antibiotics are one of the primary causes of antibiotic resistance. Inappropriate prescribing of antibiotics for illnesses such as the common cold and flu has led to the development of antibiotic resistance. In addition, patients who do not finish a full course of antibiotics can also contribute to the evolution of resistant bacteria. This has resulted in health risks that are not just confined to treating dental infections, but also pose a significant threat to global health.

**Materials and Methods:** This review is based on a thorough analysis of freely accessible literature from reputable sources such as Google, Google Scholar, and PubMed. The terms used in this review include dental, oral, maxillofacial infection, resistance pattern, epidemiology, common microorganisms, nutrition components, biofilm formation, morbidity, mortality, and increased healthcare costs. Overall, this review highlights the significant impact of dental infections and resistance on global health, including increased morbidity and mortality rates and rising healthcare costs. By understanding the epidemiology and resistance patterns of common microorganisms, as well as the role of nutrition and biofilm formation in infection prevention, we can work towards developing effective strategies for managing and

preventing dental infections.

In **conclusion**, the epidemiology of dental infections is an important area of study that helps us understand the prevalence, incidence, and risk factors associated with these infections. By understanding these factors, we can develop effective prevention and treatment strategies to improve oral health and overall well-being.

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## Introduction

Dental infections are a common occurrence, and they pose a significant threat to overall health. When left untreated, they can lead to severe complications that may affect not only oral health but also increase the risk of developing systemic diseases<sup>[1]</sup>. One of the major concerns regarding dental infections is their contribution to the spread of antibiotic resistance, which is a global issue that affects the effectiveness of antibiotics in treating infections<sup>[2]</sup>.

Dental infections are primarily caused by bacteria, which infiltrate the dental tissues, causing inflammation and pain. The most common dental infections include dental caries, periodontitis, and periapical abscesses. The severity of dental infections can vary depending on the type of infection and the degree of tissue destruction. However, their potential for spreading to other parts of the body can make them dangerous and even life-threatening<sup>[3]</sup>.

Antibiotics are often used to treat dental infections, especially those caused by bacterial infections. However, the overuse and misuse of antibiotics have contributed significantly to the emergence and spread of antibiotic resistance. Antibiotic resistance occurs when bacteria develop the ability to resist the effects of antibiotics, making it difficult to treat infections<sup>[4]</sup>. This phenomenon is a global issue that affects the effectiveness of antibiotics in treating various infections<sup>[5]</sup>.

The misuse of antibiotics in the treatment of dental infections is a significant contributor to the development of antibiotic resistance. Many patients often demand antibiotics for the treatment of dental infections, even when they are not necessary<sup>[6]</sup>. This practice can lead to the overuse of antibiotics, which can encourage the development of antibiotic-resistant strains of bacteria. Furthermore, dental healthcare providers may prescribe antibiotics without considering the type of infection or the severity of the condition, leading to the misuse of antibiotics<sup>[7]</sup>.

To mitigate the global impact of dental infections and antibiotic resistance, there is a need for better practices in dental healthcare. Dental healthcare providers should consider the use of alternative treatments, such as antifungals or antivirals, for non-bacterial infections<sup>[8]</sup>. They should also prescribe antibiotics only when necessary and for the shortest time possible, to minimize the development of antibiotic resistance. Dentists should also educate their patients on the proper use of antibiotics and the potential risks of developing antibiotic resistance<sup>[9]</sup>.

Dental infections are a serious global health concern that needs to be addressed. The use of antibiotics has been a standard treatment for dental infections; however, inappropriate use and overuse of these drugs have contributed to the emergence of antibiotic resistance<sup>[10]</sup>. Antibiotic resistance has a significant impact on global health, and it is up to healthcare providers and patients to use antibiotics appropriately and try to reduce the incidence of resistance. Furthermore, good oral hygiene care, regular check-ups, and preventive measures can significantly reduce the incidence of dental infections<sup>[11]</sup>.

## The Epidemiology of Dental Infections

Dental caries and periodontal diseases have long been recognized as the leading oral health concerns in both developed and developing nations.

Dental infections are a common occurrence that affects millions of people worldwide. Epidemiology is the study of the distribution and determinants of health and disease in populations<sup>[12]</sup>. Therefore, the epidemiology of dental infections is concerned with understanding the prevalence, incidence, and risk factors associated with these infections<sup>[13]</sup>. These conditions affect a staggering 20-50% of the global population and are the primary cause of tooth loss. To put it simply, dental caries refer to tooth decay, while periodontal diseases affect the gums and supporting structures of the teeth. Both conditions can be incredibly painful and debilitating, leading to significant discomfort and reduced quality of life<sup>[14]</sup>. Despite advances in dental care, these issues continue to pose a significant challenge to public health worldwide. It has been reported that periodontal disease is the leading cause of tooth loss among Indian patients over the age of 30, accounting for almost 80% of cases<sup>[15]</sup>. Furthermore, multiple studies have identified dental caries as a major public oral health concern in Asia, the Middle East, and sub-Saharan Africa<sup>[16]</sup>.

These findings highlight the urgent need for improved oral health education and access to preventative care in these regions. By addressing the root causes of periodontal disease and dental caries, we can help to improve the overall health and well-being of individuals and communities around the world<sup>[17]</sup>.

As healthcare professionals, it is our responsibility to stay informed about the latest research and best practices in oral health. By working together and sharing our knowledge and expertise, we can make a meaningful difference in the lives of our patients and the broader global community<sup>[18]</sup>.

Dental infections can be caused by a variety of microorganisms, including bacteria, viruses, and fungi. The most common type of dental infection is dental caries, which is caused by bacteria that produce acid that erodes the tooth enamel. Other

types of dental infections include periodontal disease, which affects the gums and bones that support the teeth, and endodontic infections, which occur inside the tooth<sup>[19]</sup>.

The prevalence of dental infections varies depending on the population being studied. In developed countries, dental caries is the most common dental infection, affecting up to 90% of school-aged children and the majority of adults. In developing countries, periodontal disease is more prevalent, affecting up to 90% of adults<sup>[20][21]</sup>.

Risk factors for dental infections include poor oral hygiene, a diet high in sugar and carbohydrates, and a lack of access to dental care. Certain medical conditions, such as diabetes and HIV/AIDS, can also increase the risk of dental infections<sup>[22]</sup>.

Prevention and treatment of dental infections involve a combination of good oral hygiene practices, such as brushing and flossing regularly, and regular dental check-ups. Treatment may also involve antibiotics or dental procedures, such as fillings or root canals<sup>[23]</sup>.

## The Common Bacteria that Cause Dental Infection

The most commonly isolated genera include anaerobic *streptococci*, *Fusobacterium* species, *Prevotella* and *Porphyromonas* species<sup>[24]</sup>. *Prevotella* species have been reported as the most frequent isolates in numerous studies, found in 10-87% of dentoalveolar abscesses. *Prevotella intermedia*, *Prevotella nigrescens* and *Prevotella pallens*, *Porphyromonas endodontalis*, and *Porphyromonas gingivalis* are the commonly detected pathogens<sup>[25]</sup>

*Bacteroides fragilis*, a more common isolate from intra-abdominal infections, has only infrequently been reported from acute dentoalveolar infections and is not regarded as an oral commensal.<sup>[26]</sup> The member of the *Bacteroides* genus most likely to be recovered from an acute dental abscess is *Bacteroides forsythus* (now transferred to a new genus as *Tannerella forsythia*).<sup>[27]</sup>

Facultative anaerobes belong to the *viridans* group *streptococci* and the *anginosus* group *streptococci* are commonly implicated in dental abscess. The *viridans* group *streptococci* includes mitis group, *oralis* group, *salivarius* group, *sanguinis* group, and the *mutans* group.<sup>[28]</sup> The *anginosus* group (formerly referred to as “*Streptococcus milleri*” or *S. anginosus*) has also been reported with varying degrees of accuracy.

*Staphylococcus aureus* has been frequently reported from acute dental abscess, ranging from 0.7% to 15%.<sup>[6]</sup> Recovery rates of coagulase-negative strains of *staphylococci* (usually reported as *Staphylococcus epidermidis*) are generally higher with figures ranging from 4% to 65%.<sup>[29]</sup>

## Antibiotics Resistance

Oral anaerobes implicated in infection include members of the genera *Fusobacterium* and *Veillonella*; these bacteria have been associated with penicillin resistance.<sup>[30]</sup> In one study, 31% of *fusobacteria* isolated from odontogenic abscesses were found to produce  $\beta$ -lactamase. Other workers are recommending clindamycin for the first-line treatment of

odontogenic infections because of the problems of  $\beta$ -lactamase production amongst the bacteria that cause this polymicrobial condition.<sup>[31]</sup>

Resistance to  $\beta$ -lactams such as penicillins and cephalosporins is found in the oral flora, but the prevalence and degree of resistance is unclear. The potential to pass high-level resistance to *S. pneumoniae* makes it particularly important that the prevalence is determined with greater accuracy than is currently the case.<sup>[32]</sup>

Tetracycline resistance is widespread. Furthermore, tetracyclines are used infrequently in dental practice because of the side-effects associated with this family of drugs, which can affect tooth color. Association of resistance to tetracyclines with penicillin and erythromycin resistance makes the high prevalence of tetracycline resistance potentially dangerous. Its presence may facilitate the dissemination of other resistance determinants.<sup>[33]</sup>

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