THERAPEUTIC APPROACH TO ODONTOGENIC INFECTIONS: THE ROLE OF ANTIBIOTIC THERAPY IN CLINICAL TREATMENT

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ABSTRACT

Introduction: Odontogenic infections are common causes of emergency dental care and can progress to severe conditions with risk of systemic dissemination. These infections result from untreated caries, periodontitis, pericoronitis, and post-dental complications. The therapeutic approach is based on the removal of the infectious focus, combined with the judicious use of antibiotic therapy. The indiscriminate use of antibiotics can lead to bacterial resistance, making rational prescription based on clinical criteria and up-to-date guidelines essential. **Objective:** This study aims to analyze the importance of antibiotic therapy in the treatment of odontogenic infections, addressing the criteria for its indication, the main drugs used and the guidelines for safe and effective use. **Methodology:** A literature review was conducted with searches in the PubMed and SciELO databases, including studies published between 1957 and 2025. DeCs/MeSH indexed descriptors related to antibiotic therapy and odontogenic infections were used. Only full articles in Portuguese or English were considered, excluding expert opinions and studies that are not available in full. **Results:** The primary approach in the treatment of odontogenic infections consists of removal of the cause and surgical drainage. Antibiotic therapy is guided by an antibiogram; However, in cases where there is no time to wait for the results, the empirical prescription can be adopted. Studies indicate that the prescription of antibiotics should be made for the shortest possible time based on laboratory tests showing the suppression of the infection after the surgical intervention. One analysis showed that only 12% of dentists prescribe antibiotics properly. In addition, odontogenic infections are often caused by Gram-positive cocci (65%) and Gram-negative bacilli (25%), and microbiological culture and antibiogram are essential for the correct choice of antimicrobial. **Conclusion:** The rational use of antibiotics in odontogenic infections is essential to ensure the efficacy of treatment and minimize microbial resistance. The therapeutic approach should prioritize the mechanical removal of the infection associated with antibiotic therapy based on well-defined clinical criteria. The antibiogram is a valuable tool for the proper selection of drugs, ensuring a more effective and safe treatment for patients.

Keywords: Antibiotic therapy; odontogenic infections; Clinical Treatment.

INTRODUCTION

Odontogenic infections represent one of the main reasons for seeking emergency dental care, ranging from localized abscesses to more severe conditions with risk of systemic dissemination. These infections usually result from pathological processes such as untreated caries, periodontitis, pericoronitis, and complications from dental procedures. The oral microbiota, composed predominantly of facultative aerobic and anaerobic bacteria, plays a crucial role in the genesis of these infections, which can compromise not only oral health but also the systemic status of the patient (Kudiyirickal and Hollinshead, 2012).

The management of these infections requires a combined therapeutic approach, based on the elimination of the infectious focus through dental procedures, such as drainage of abscesses and removal of necrotic tissues, combined with the judicious use of antibiotic therapy. Although antibiotics are essential in the control of more severe odontogenic infections, their indiscriminate use can lead to complications, including adverse reactions, gastrointestinal disorders, and, above all, the worsening of bacterial resistance, a problem of great concern in global public health (Wilson et al., 2021).

The choice of the appropriate antimicrobial should consider the microbiological profile of the infection, the severity of the clinical picture, and the patient's general conditions. Although antibiotic therapy is essential in many cases, its use must follow strict criteria, being indicated only when there is a real need. In localized odontogenic infections, such as restricted abscesses without systemic signs or pericoronitis without complications, treatment can be performed with drainage alone, removal of the causative factor, and local measures. Clinical guidelines emphasize that the mechanical and surgical approach should be prioritized whenever possible, reserving antibiotics for situations in which their prescription is justified. In this way, its judicious use ensures the effectiveness of the treatment and minimizes the risks associated with excessive use (Halling et al., 2017).

In this context, this study aims to discuss the importance of antibiotic therapy in the treatment of odontogenic infections, addressing criteria for its indication, the main drugs used and the most current guidelines for safe and effective use. Understanding these aspects is essential to optimize therapeutic management, ensuring infection control and minimizing risks to the patient and public health.

METHODOLOGY

The articles that made up this literature review were searched in the following databases: Pubmed and SciELO; between the years 1957 and 2025, with full text in Portuguese or English, which had the indexed descriptors DeCs/MeSH combined or not:

Antibiotic therapy; odontogenic infections; Clinical Treatment. Articles were included in the study that presented discussions about the therapeutic approach to odontogenic infections addressing the role of antibiotic therapy. Articles that were not available in full and expert opinions were excluded from the study.

RESULTS

The primary approach in the treatment of odontogenic infections is elimination of the cause and surgical drainage. Antibiotic therapy, although essential in certain cases, should be used with discretion. Its use is indicated when there are signs of systemic dissemination, involvement of deep spaces, or increased risk of complications. However, in localized infections, such as restricted abscesses or uncomplicated pericoronitis, mechanical and surgical intervention is usually sufficient to resolve the condition, avoiding the unnecessary prescription of antimicrobials. This approach not only optimizes treatment, but also reduces the risks associated with the indiscriminate use of antibiotics.

Current guidelines recommend the use of antibiotics only after removal of the source of infection, with an indication of 2 to 3 days of postoperative treatment. Studies show that extending this period offers no additional benefits and is therefore not recommended (Martins et al., 2017). Excessive and unnecessary use of antibiotics can lead to inappropriate prescriptions, increasing the risk of adverse reactions and contributing to bacterial resistance, a critical public health issue (Halling et al., 2017). On the other hand, a systematic review by Ribeiro et al. (2025) suggests that shorter antibiotic regimens, usually between 3 and 5 days, are effective when combined with surgical interventions, reducing complications and minimizing the development of bacterial resistance.

The work by Koyuncuoglu CZ et al. (2017), retrospectively analyzed dental prescription records, aiming to assess whether these prescriptions were aligned with established clinical guidelines. The results showed that only about 12% of dentists prescribe antibiotics appropriately, either as a prophylactic intervention or for treatment. The three most common conditions for which antibiotics were prescribed included periapical abscess without fistula (28.1%), dental examination (20.7%), and tooth decay (16.2%). However, a significant proportion of these prescriptions were not in line with the guidelines, indicating a potentially inappropriate use of the drugs. The study concluded that there is an urgent need to improve the education and awareness of dentists on the rational use of antibiotics. Compliance with clinical guidelines is essential to avoid unnecessary prescriptions, reduce the risk of antimicrobial resistance, and ensure greater safety for patients.

The indiscriminate use of antibiotics in dentistry represents a critical problem, as it can trigger several adverse effects, including bacterial resistance, gastrointestinal complications, hematological alterations, and disturbances in the oral and systemic microbiota (Ostrander, 1957; Poveda Roda et al., 2007). Bacterial resistance, in particular, arises when bacteria are repeatedly exposed to antibiotics unnecessarily, allowing resistant strains to proliferate reducing the effectiveness of conventional treatments (Sweeney et al., 2004). This phenomenon compromises not only the management of odontogenic infections, but also the success of systemic medical interventions , since the oral cavity functions as a reservoir of resistant microorganisms that can spread to other parts of the body.

In addition, the oral microbiota plays a key role in maintaining homeostasis and defending against opportunistic pathogens. The unnecessary use of antibiotics can eliminate beneficial bacteria, favoring the uncontrolled growth of potentially pathogenic microorganisms and increasing the risk of secondary infections and local and systemic inflammatory disorders (Poveda Roda et al., 2007). Changes in the microbiota may also be associated with gastrointestinal disorders, such as diarrhea and colitis associated with *Clostridium difficile*, especially in immunosuppressed patients or those with comorbidities.

Another worrying factor is the impact of antibiotic overuse on hematological health. Some antimicrobials can induce adverse effects such as hemolytic anemia, thrombocytopenia, and agranulocytosis, conditions that compromise the patient's immune response and can hinder recovery from odontogenic infections (Sweeney et al., 2004).

In view of these risks, it is essential to adopt a rational approach to the prescription of antibiotics, prioritizing short-spectrum agents and limiting their use to acute odontogenic infections, where there is a real therapeutic need. Strategies such as microbiological culture and susceptibility testing can contribute to more targeted treatment, reducing unnecessary exposure to antibiotics and preventing the emergence of bacterial resistance. In addition, continuing education of dental professionals and conducting research on new antimicrobial strategies are key to containing the spread of resistant bacteria and ensuring effective management of dental infections (Poveda Roda et al., 2007).

The study conducted by Siddiqui et al. (2007) aimed to identify the predominant microorganisms in odontogenic infections and to evaluate their sensitivity to antibiotics. The research was conducted with 80 patients diagnosed with orofacial infections, from whom samples were collected for isolation and microbiological identification. In total, 109 microorganisms were identified, 107 bacteria and 2 fungi. The results showed that Gram-positive cocci are responsible for approximately 65% of orofacial infections, while Gram-negative bacilli are present in about 25% of the specimens analyzed. These infections

occur more frequently in individuals between 21 and 40 years of age, with no significant association with the gender of the patients (Kudiyirickal and Hollinshead, 2012; González-Martínez et al., 2012.).

CULTURE and ANTIBIOGRAM

Culture and antibiogram are essential laboratory methods for the identification of microorganisms and the determination of their sensitivity to antibiotics, playing a fundamental role in the rational use of these drugs. Microbiological culture allows the isolation of the causative agent of the infection from clinical samples, enabling an accurate identification of the pathogen involved. The antibiogram, in turn, evaluates the susceptibility of this microorganism to different antimicrobials, providing crucial information for choosing an appropriate treatment (Poveda Roda et al., 2007).

The main advantage of this technique lies in the possibility of selecting an effective and short-spectrum antibiotic (Sweeney et al., 2004). In addition, the proper use of the antibiogram can minimize therapeutic failures, reduce adverse reactions, and ensure a safer and more effective treatment for patients (Ostrander, 1957). The technique involves inoculation of the isolated microorganism in appropriate culture media, followed by exposure to antibiotic-impregnated discs (agar diffusion method) or determination of the Minimum Inhibitory Concentration (MIC) by broth microdilution, allowing a detailed analysis of microbial resistance and optimizing the clinical approach (Poveda Roda et al., 2007). Thus, culture and antibiogram become indispensable tools for a more rational management of odontogenic infections, promoting the judicious use of antimicrobials and helping to contain the spread of resistant bacteria.

The table below presents the microbiology commonly found in odontogenic infections:

TABLE 1 - CHARACTERIZATION OF THE RECURRENT MICROBIOLOGY OF INFECTIONS

Gender	Middle	Cell Wall	Morphology
Fusobacterium	anaerobic	Gram-	pleomorphic
Bacteroides	anaerobic	Gram-	bacillus
Staphylococcus	Optional anaerobic	Gram+	Staph
Streptococcus	Optional anaerobic	Gram+	Strep
Peptostreptococcus	anaerobic or microaerophilic	Gram+	Coconuts or Streptococci
Pseudomonas	aerobic	Gram-	bacillus
Porphyromonas	anaerobic	Gram-	bacillus
Actinomyces	anaerobic or facultative anaerobic	Gram+	bacillus

ANTIBIOTICS

The indication of antibiotics in dentistry should be judicious and based on scientific evidence, considering the benefits and risks associated with their use. In some situations, antibiotic prophylaxis is necessary, especially for patients with systemic conditions that increase the risk of serious infections, such as bacterial endocarditis. According to Poveda Roda et al. (2007), antibiotic prophylaxis is indicated before invasive dental procedures in patients with predisposing heart diseases, such as valvular heart diseases, history of infective endocarditis, uncorrected cyanotic congenital heart diseases or valve prostheses. In addition, patients undergoing organ transplants, using immunosuppressive therapy, or with recent joint prostheses may also require prophylaxis to prevent the spread of microorganisms to these structures.

In this context, Kumar, Singh, and Gupta (2014), point out that immunosuppressed patients, individuals with a history of cancer, those with previous infective endocarditis, and patients with metabolic disorders, such as decompensated diabetes mellitus and splenectomy, have an increased risk of bacterial spread after invasive dental procedures. In addition, patients with prosthetic joints, indwelling catheters, neurosurgical shunts, valvular heart disease, surgical pulmonary shunts, hypertrophic cardiomyopathy, mitral valve prolapse, and prosthetic heart valves also require a prophylactic approach to minimize the risk of potentially fatal systemic infections (Martínez et al., 2004).

In addition to prophylaxis, antibiotics are also recommended in the treatment of odontogenic infections that show signs of systemic dissemination, such as fever, lymphadenopathy, extensive cellulitis, trismus, and respiratory distress, situations in which the body may not be able to contain the infection with local treatment alone (Poveda Roda et al., 2007). In the surgical context, Schwartz and Larson (2007) highlight that the prophylactic administration of antibiotics can reduce the risk of postoperative infections in procedures such as complex tooth extractions, extensive bone surgeries, and implant placement, especially in immunocompromised patients, decompensated diabetics, or those with a history of recurrent odontogenic infections.

Therefore, the indication of antibiotics may occur for the treatment of infections of odontogenic origin, infections of non-odontogenic origin and prevention of local infections. For cases of prevention of local infection, the drugs elucidated in the literature are:

CHART 2 - ANTIBIOTIC PROPHYLAXIS 30-60 minutes before the procedure			
Situation	**Agent**	**Adult**	**Children**
Oral	Amoxicillin	2G	50mg/kg
Penicillin (oral) allergy	Cephalexin Azithromycin/Clarithromycin A Doxycycline	2G 500mg 100mg	50mg/kg 15mg/kg 2.2mg/kg (<45kg) 100mg/Kg (>45Kg)
Parenteral	Ampicillin Cefazolin/Ceftriaxone	2G IM or IV 1G IM or IV	50mg/Kg IM or IV 50mg/Kg IM or IV
Penicillin (parenteral) allergy	Cefazolin/Ceftriaxone Clindamycin	1G IM or IV 600mg IM or IV	50mg/kg 20mg/kg

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The treatment of odontogenic infections should be conducted based on well-defined criteria, and culture and antibiogram are essential tools for identifying the etiological agent and choosing the most appropriate antimicrobial. These tests make it possible to isolate the responsible bacteria and select the most specific drug for the identified species, ensuring a more effective treatment and reducing the risk of antimicrobial resistance. However, while awaiting the result of the antibiogram, it is necessary to institute an empiric short-spectrum antibiotic, focusing on the microorganisms most commonly associated with the patient's clinical condition.

Odontogenic infection begins with the gradual colonization of bacteria in the dental biofilm, reaching the periodontal and dental tissues. Initially, aerobic microorganisms, such as facultative Streptococcus, predominate and synthesize hyaluronidase, an enzyme that degrades hyaluronic acid, facilitating the spread of infection and triggering cellulitis, with a predominance of aerobic microorganisms. With the progression of the infection, there is a reduction in oxygen and tissue pH, favoring the growth of anaerobic bacteria. These release collagenases, promoting collagen lysis and tissue necrosis, leading to the formation of microabscesses, which coalesce until they form a clinically visible abscess, where anaerobic microorganisms predominate.

Thus, based on the patient's clinical symptomatology and the predominance of microorganisms, the choice of the most appropriate antibiotic is defined. In addition, a

careful evaluation of the patient's systemic condition is essential to determine whether the indicated antimicrobial should be bacteriostatic, inhibiting bacterial replication and requiring an efficient immune response, or bactericidal, promoting the direct destruction of bacteria, being preferable in immunosuppressed patients or in more severe infections. Thus, the therapeutic choice must be individualized, considering the infectious agent, the patient's immunological status, and the severity of the infection.

Next, the main classes of antimicrobials used in the treatment of odontogenic infections will be analyzed, highlighting their mechanisms of action, coverage spectrum and determining factors for a more accurate therapeutic choice. Thus, the therapeutic approach must be individualized, ensuring efficacy in controlling the infection and minimizing potential adverse effects.

DRUGS

- **Penicillins:** Penicillin is widely used in odontogenic infections. The main types prescribed include penicillin V, amoxicillin, and amoxicillin/clavulanate, all of which have similar efficacy. About 70% of bacteria isolated from odontogenic infections are susceptible to penicillin. Despite being the first choice for its effectiveness and low cost, it can cause adverse effects such as nausea, diarrhea, and allergic reactions. Clindamycin is indicated for allergic patients.
- **Penicillin V:** It remains in circulation longer than penicillin G. The recommended dose is 500 mg every 6 hours orally, and can be associated with metronidazole.
- **Amoxicillin:** First-line antibiotic against gram-negative bacilli. It can be combined with metronidazole or clavulanic acid. The usual dosage is 500 mg every 8 hours or 1000 mg every 12 hours.
- **Amoxicillin/Clavulanic Acid:** It has a broad spectrum and is the second most common choice in dentistry. Indicated for cases resistant to amoxicillin, with doses of 875/125 mg every 8 hours or 2000/125 mg every 12 hours. It can cause hepatotoxicity and changes in the oral microbiota.
- **Ampicillin:** Broad-spectrum beta-lactam, less effective than amoxicillin. Indicated for aerobic and anaerobic infections in patients who cannot take oral medication. Prophylactic dose: 2 g IV/IM before the procedure.
- **Cephalosporins:** Beta-lactams effective against aerobic bacteria, and can be combined with metronidazole.
- **Nitroimidazoles (Metronidazole):** Used against anaerobic bacteria and periodontal infections, with low toxicity. The usual dose is 500-750 mg every 8

hours. It interacts with alcohol and warfarin and can cause adverse effects such as neuropathy.

- **Macrolides:** Bacteriostatic drugs effective against beta-hemolytic streptococci. Contraindicated in patients with progressive cirrhosis.
- **Erythromycin:** It acts against *Streptococcus mutans* and bacterial plaque, but has a high rate of adverse effects. Dose: 250-500 mg every 6 hours.
- **Azithromycin:** Alternative for allergy sufferers to penicillin. Dose: 500 mg/day for 3 days or 500 mg 1h before procedures.
- **Clarithromycin:** Effective against anaerobic gram-positive bacilli. Dose: 500 mg 1h before the procedure. It can modulate heart inflammation.
- **Lincosamides (Clindamycin):** Bacteriostatic effective against aerobes and anaerobes, indicated for persistent infections and allergy to penicillin. Dose: 300-600 mg every 8 hours. It can cause pseudomembranous colitis and is contraindicated in cirrhosis and ulcerative colitis.
- **Fluoroquinolones:** Broad-spectrum bactericides with high tissue penetration. Not recommended for children due to the risk of chondrotoxicity.
- **Ciprofloxacin:** Active against Gram-positive and Gram-negative pathogens. Dose: 500 mg every 12 hours. It can cause gastrointestinal problems and interact with theophylline.
- **Moxifloxacin:** Fourth-generation fluoroquinolone, effective against several bacteria. Indicated for respiratory and skin infections. It can cause adverse effects such as peripheral neuropathy and tendon disorders.

The results analyzed highlight the importance of antibiotic therapy in the treatment of odontogenic infections, especially in containing bacterial spread and reducing morbidity. However, it is essential to emphasize that therapeutic success depends, first, on the removal of the infectious cause through surgical drainage and other appropriate local procedures. Antibiotic therapy should be used judiciously, ensuring greater therapeutic efficacy and avoiding the development of bacterial resistance. In addition, the association of antibiotics with beta-lactamase inhibitors proved to be an efficient strategy to broaden the antimicrobial spectrum and control infections caused by resistant pathogens, promoting safer and more effective clinical management.

CONCLUSION

It is concluded that the management of odontogenic infections requires a rigorous therapeutic approach, based on an accurate diagnosis, careful selection of antibiotics and careful monitoring of the patient's response. Antibiotic therapy, when conducted strategically, should integrate culture and antibiogram tests, as well as knowledge of the empirical approach based on clinical presentation. The choice of drug should be based on the predominant microbiota and the immunological capacity of the host. Such guidelines are essential to contain the spread of infection, mitigate complications, and ensure the systemic integrity of the patient.

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