Use of Antibiotic Therapy for Pediatric Dental Patients

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Abbreviations
Majr: Medical subject headings major topic.
Tiab: Title and abstract.

* *Used in the PubMed search to identify all terms that begin with this truncated base.*

Abstract
This best practice provides clinicians with guidance in the safe and effective use of antibiotics to treat oral infections and dental traumatic injuries. When prescribed judiciously and administered as directed, antibiotics can be effective in the prevention and treatment of oral bacterial infections. Antibiotic stewardship is important given the rise in antibiotic-resistant microorganisms and potential for adverse drug reactions. This document addresses the following clinical conditions: oral wounds, pulpitis/apical periodontitis/draining sinus tract/localized intraoral swelling, acute facial swelling of dental origin, dental trauma, periodontal diseases, and salivary gland infections and offers guidance on the judicious use of antibiotics in their management. Antibiotics are not indicated in the management of conditions of viral origin. Potential interactions between antibiotics and oral contraceptives are addressed. Health care providers must be prudent in their prescribing practices to maximize effectiveness and minimize bacterial resistance and adverse reactions.

This document was developed through a collaborative effort of the American Academy of Pediatric Dentistry Councils on Clinical Affairs and Scientific Affairs to offer updated information and guidance on the use of antibiotic therapy for pediatric dental patients.

KEYWORDS: ANTIBIOTICS; ANTIMICROBIAL RESISTANCE; DENTAL INFECTION CONTROL, BACTERIAL INFECTIONS

Purpose
The American Academy of Pediatric Dentistry recognizes the increasing prevalence of antibiotic-resistant microorganisms and potential for adverse drug reactions and interactions. These recommendations are intended to provide guidance in the proper and judicious use of antibiotic therapy in the treatment of oral conditions. The use of antibiotic prophylaxis for dental patients at risk for infection is addressed in a separate best practices document.[1] Information regarding commonly prescribed antibiotics can be found in the American Academy of Pediatric Dentistry's *Useful Medications for Oral Conditions*.[2]

Methods
Recommendations on the use of antibiotic therapy were developed by the Council on Clinical Affairs, adopted in 2001,[3] and last revised in 2022.[4] This revision was based upon a new literature search of the PubMed/MEDLINE database using the terms: (*evidence based dentistry* [**Majr**] OR *pediatric dentistry* [Majr] OR *dental care for children* [Majr] OR *paediatric dentistry* [**Tiab**] OR *dental health services* [Majr] OR *dentistry* [Majr] OR *oral health* [Majr]) *AND* (*antibiotic therap** [Tiab] OR *antibacterial agent** [Tiab] OR *dental trauma* [Tiab] OR *orofacial infect** [Tiab] OR *periodontal disease** [Tiab] OR *oral contracep** [Tiab] OR *facial cellulitis* [Tiab]); fields: all; limits: within the last 10 years, humans, English, birth through age 18. Three hundred forty-eight articles matched these criteria. Papers for review were chosen from this

search and from other sources and articles found in the previous version of this best practice. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

Background

Management of odontogenic and other orofacial infections often includes treatment with antibiotics. Antibiotics are beneficial to patient care when prescribed judiciously and administered as directed for bacterial infections. If antibiotics are prescribed for at-home use, providing parental education regarding optimal timing, dosage, and duration of treatment may encourage increased compliance and efficacy of the medication.[5,6] Oral health disparities have led to increased frequency of orofacial infections requiring more intensive management among children without an established dental home or with special health care needs.[7] If the extent of infection or medical susceptibility warrants hospital admission, intravenous antibiotic administration will contribute to a more rapid cure.

While indicated for high-risk dental infections, the widespread use of antibiotics has permitted common bacteria to develop resistance to drugs that once controlled them.[8,9] Drug resistance is prevalent throughout the world.[8,9] Each year in the US, nearly 3 million antibiotic-resistant infections occur and result in more than 35,000 deaths.[8] Some microorganisms may develop resistance to a single antimicrobial agent, while others develop multi-drug-resistant strains.[9] Conservative use of antibiotics is indicated to minimize the risk of developing resistance to current antibiotic regimens.[8-10]

Adverse events such as allergic reactions, development of *Clostridioides difficile* infection, or drug interactions and side effects can occur.[8,11] Antibiotics are a common cause of emergency department visits for adverse drug events in children under the age of 18 years, with amoxicillin as the most commonly implicated drug in children less than 9 years and sulfamethoxazole-trimethoprim in children aged 10-19.[12]

Amoxicillin, considered the first drug of choice for dental infections in non-allergic children[13], is effective against a wide variety of gram-positive bacteria and offers greater gram-negative coverage than penicillin.[14] It has been shown to be effective against oral flora,[15] be well absorbed from the gastrointestinal tract,[10] provide high, sustained serum concentrations,[10] and have a low incidence of adverse effects.[15] Clindamycin has been associated with significant adverse drug reactions related to community-acquired *Clostridioides difficile* infections.[10] Up to 15% of community-acquired *Clostridioides difficile* infection has been attributed to antibiotics prescribed for dental procedures.[10] Doxycycline is recommended as an alternative to penicillin, cephalosporin, and macrolide allergy.[2,10] Although not typically recommended for children, doxycycline—when used short-term (<21 days)—has not been associated with tooth discoloration in children under 8 years of age.[16-18] Azithromycin is one of the safest antibiotics for patients allergic to penicillins, but there are risks of cardiac complications including cardiotoxicity.[19] The small, heightened risk appears to be related to preexisting cardiovascular risk factors including prior myocardial infarction, diabetes, age, and gender.[20] Cardiac risk in pediatric patients seems to be due to an increased risk of QT prolongation associated with higher dosage levels.[19]

Recommendations

Practitioners should adhere to the following general principles for antibiotic usage[10,21] for the pediatric dental patient.

- Prevention of dental diseases should be emphasized in order to reduce the need for antibiotic intervention.
- Antibiotics should be prescribed only when truly needed to treat a bacterial infection and only as an adjunct to, not an alternative for, other interventions (eg, pulp therapy, extraction, scaling and root planing) implemented to control the infection source.[22]
- Antibiotics should be selected based on properties of the agent (eg, spectrum of coverage, safety), previous antibiotic use, and patient considerations (eg, medical history, drug allergies, current medication use, ease of use) and then prescribed at an adequate pediatric dose.

- The most effective route of drug administration (intravenous versus intramuscular versus oral) must be considered. If the patient is receiving parenteral antimicrobial therapy for treatment of existing infections, the same antibiotic can be continued orally after discontinuation of parenteral therapy.[10]
- Consultation with an infectious disease physician is recommended if there is concern for resistant infections.
- The traditional minimal duration of drug regimen is 5 days beyond the point of substantial improvement (eg, improved healing of wound, reduction of erythema or swelling, reduction of signs and symptoms). Usually, this is a 5- to 7-day course of treatment, dependent upon the specific drug selected.[23,24]
- However, in light of the growing problem of drug resistance, discontinuation of antibiotics should be considered following determination of either ineffectiveness or cure prior to completion of a full course of therapy.[25,26] In the case of odontogenic infections, a 3- to 5-day course of amoxicillin may be as effective as a 7-day course.[27-29]
- If an infection is not responsive to the initial drug selection, a culture and sensitivity testing from the infection site or, in some cases, a blood microbiology and culture and sensitivity may be indicated.[8.25]
- Individuals suspected to have an allergy to antibiotics may be referred for allergy testing to confirm or refute the presence of a true allergy. Suspected allergenic medications should not be used until allergy testing confirms safety.[30,31]
- Prescriptions should be documented in the patient's dental record.[32]

Additional considerations for specific clinical circumstances are discussed below.

Oral wounds

Factors related to host risk (eg, age, systemic illness, malnutrition, immune compromise) and type of wound (eg, laceration, puncture) must be evaluated when determining the risk for infection and subsequent need for antibiotics. Wounds can be classified as clean, potentially contaminated, or contaminated/dirty. Facial lacerations and puncture wounds may require topical antibiotic agents.[33] Intraoral puncture wounds and lacerations that appear to have been contaminated by extrinsic bacteria, debris (eg, dirt, soil, gravel), foreign body, open fractures, and joint injury have an increased risk of infection and should be managed by systemic antibiotics.[33] If antibiotics are deemed beneficial to the healing process, the timing of their administration is critical to supplement the natural host resistance in bacterial killing.[8] For puncture wounds and dirty lacerations, confirmation that tetanus immunity is up to date is indicted.[34]

Pulpitis/apical periodontitis/draining sinus tract/localized intraoral swelling

If a child presents with acute symptoms of irreversible pulpitis, treatment (ie, pulpotomy, pulpectomy, or extraction) should be rendered. Antibiotic therapy is not indicated nor effective if the dental infection is contained within the pulpal tissue or the immediate surrounding tissue. In this case, the child will have no systemic signs of an infection (ie, no fever, no facial swelling).[35]

Acute facial swelling of dental origin

A child presenting with a facial swelling or facial cellulitis secondary to an odontogenic infection should receive prompt dental attention. The clinician should consider age, cooperation, the ability to obtain adequate anesthesia (local versus general), the severity of the infection, the medical status, and any social issues of the child.[36,37] Antibiotics can be used as an adjunctive measure to halt the local spread of infection and control swelling but should not replace surgical intervention (ie, source control and drainage).[38-40] Amoxicillin and amoxicillin with clavulanic acid remain the empirical choice for odontogenic infections.[26,41] Cephalosporins could be considered as an alternative choice for management of odontogenic infections, especially when a child has had a previous course of penicillin/amoxicillin or has a penicillin allergy.[41] Appropriate antibiotic stewardship efforts should emphasize the narrowest spectrum of antibiotics for the shortest duration that can adequately treat antibiotic infections.[22,42]

In cases of severe acute infection with profound swelling, antibiotic loading doses can more rapidly achieve therapeutic drug concentrations and prompt clinical response.[26] For odontogenic infections with nonlocalized and progressive swelling and systemic manifestations (eg, fever, difficulty breathing or swallowing), immediate surgical intervention and medical management with intravenous antibiotic therapy contribute to a more rapid cure.[27,29,37,43p405,44,45] For severe odontogenic infections, intravenous antibiotics—which commonly include ampicillin/sublactam and cefazolin[26]—typically necessitate a hospital-based setting.[46] Signs of systemic involvement and septicemia (eg, fever, malaise, asymmetry, facial swelling, lymphadenopathy, trismus, tachycardia, dysphagia, airway compromise, respiratory distress) warrant emergency treatment.[43p405,44] Additional imaging (eg, radiographs, ultrasound, computed tomography scan) and testing (eg, complete blood examination, c-reactive protein, bacterial culture and sensitivity testing) can aid in assessment and diagnosis.[36,37]

Avulsions

Systemic antibiotics have been recommended as adjunctive therapy for avulsed permanent incisors with an open or closed apex.[15] Amoxicillin or penicillin is the drug of choice due to effectiveness against oral flora and low incidence of adverse effects.[15] Doxycycline is recommended as an alternative to penicillin.[15] Doxycycline exhibits antimicrobial, anti-inflammatory, and antiresorptive properties which make its use appropriate for dental trauma.[15,47] Using topical antibiotics (minocycline or doxycycline) to enhance pulpal revascularization and periodontal healing in immature nonvital traumatized teeth has shown potential in animal studies, but usage has not been proven effective in human studies, remains controversial, and has not been recommended by the International Association of Dental Traumatology.[15] Further randomized clinical trials are needed.[15] Antibiotics can be warranted in cases of concomitant soft tissue injuries (see **Oral wounds**) and when dictated by the patient's medical status.

Pediatric periodontal diseases

Three distinct forms of periodontal disease have been defined as: (1) periodontitis (grouping the 2 forms formerly recognized as aggressive or chronic); (2) necrotizing periodontitis; and (3) periodontitis as a manifestation of systemic disease.[47] Patients diagnosed with what formerly was known as aggressive periodontal disease may require adjunctive antimicrobial therapy in conjunction with localized treatment.[48-50] In pediatric periodontal diseases associated with systemic conditions (eg, severe congenital neutropenia, Papillon Lefèvre syndrome, leukocyte adhesion deficiency), the immune system is unable to control the growth of periodontal pathogens and, in some cases, treatment may involve antibiotic therapy or antibiotic prophylaxis.[48,51] Culture and susceptibility testing of isolates from the involved sites are helpful in guiding the drug selection.[52] In severe and refractory cases, extraction is indicated.[52]

Salivary gland infections

For acute salivary gland swellings of bacterial nature, antibiotic therapy is indicated.[53] If the patient does not improve in 24-48 hours on antibiotics alone, incision and drainage may be warranted.[8] Amoxicillin/clavulanate is used as empirical therapy to cover both staphylococcal and streptococcal species as most bacterial infections of the salivary glands originate from oral flora.[53]

Oral contraceptive use

Although caution previously was advised with the concomitant use of antibiotics and oral contraceptives,[54,55] a 2018 systematic review of drug interactions between non-rifamycin antibiotics and hormonal contraception found that most women can expect no reduction in hormonal contraceptive effect with the concurrent use of non-rifamycin antibiotics.[55]Most broad-spectrum antibiotics do not alter the contraceptive effectiveness of combined hormonal contraceptives.[56,57p44] In addition, no differences in ovulation were found when oral contraceptives were combined with ampicillin, doxycycline, temafloxacin, ofloxacin, ciprofloxacin, clarithromycin, roxithromycin, dirithromycin, or metronidazole.[56,57p44] Women should be encouraged to take oral contraceptives correctly and consistently at all times, including during periods of illness.[56,57p44] Rifamcyin antibiotics, such as rifampin or rifabutin, induce hepatic enzymes that

are required for hormonal contraceptive metabolism, which could compromise the contraceptive or antibiotic effect.[55-57p44]

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