The use of Antibiotics in Paediatric Dentistry: A Revision of Current Recommendations

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Abstract: Antibiotics are commonly used in medicine and dentistry for both preventive and therapeutic reasons. They are most widely prescribed medications in paediatric dentistry. According to the literature, approximately 7-11% of antibiotic therapy is prescribed by dentists. The most commonly used are β-lactam antibiotics, macrolides, tetracyclines, clindamycin, metronidazole. Unrestricted use of antibiotics is a cause of growing bacterial resistance. The aim of the study was to review the literature for the clinical indications, dosages, and duration of antibiotic therapy in the field of peadiatric dentistry. The author reviewed the scientific literature and for evidence regarding the use of antibiotics to prevent local and systemic infections associated with dental treatment in children. Actual recommendations and clues for clinician are provided in this article.

Keywords: Antibiotics, Amoxicillin, Orofacial infections, Odontogenic infection, Antibiotic prophylaxis, Children.

INTRODUCTION

Antibiotics are commonly used in medicine and dentistry for both preventive and therapeutic reasons. They are most widely prescribed medications in paediatric dentistry [1]. It has been reported that about a third of antibiotics used are prescribed to patients unnecessarily due to a lack of knowledge of the appropriate clinical indications for antibiotic use [2]. This insufficient knowledge of the current recommendations promotes the overuse of antibiotics and contributes to the emergence of antibiotic resistance among children [3, 4]. According to the literature, approximately 7-11% of antibiotic therapy is prescribed by dentists. The most commonly used are β-lactam antibiotics, macrolides, tetracyclines, clindamycin, metronidazole [5]. Unrestricted use can promote resistant bacterial strains. The growing resistance of bacteria to antibiotics is well evidenced in children and is a serious global health problem [1, 4]. Among the inappropriate reasons for ordering antibiotics, they are administered fo analgesia (*e.g*. during endodontic treatment) or instead of surgical treatment (rather than abscess incision or tooth extraction). An example of frequent misuse is also the prevention of post-operative infections in generally-healthy patients [5]. Antibiotic therapy is associated with the risk of side effects, which may be universal or specific for a given group of drugs. Treatment with antibiotics has a particularly negative effect on the developing organism of a child [5]. Oral antibiotics can cause disorders of the digestive system and the composition of the intestinal microflora, the symptoms of which are abdominal pain, nausea, vomiting, diarrhea or inflammatory bowel disease. The risk of developing inflammatory bowel disease in childhood patients treated with antibiotics was estimated to be more than 80% higher than in those who were not treated with them. There is also a link between the use of antibiotics in infancy and early childhood, and asthma and allergies [5-7]. On the other hand, antibiotic underuse may lead to prolonged disease duration and increased rate of disease-related complications, both of which may be avoided with immediate treatment of the bacterial infection [2, 8].

The aim of the study was to review the literature for the clinical indications, dosages, and duration of antibiotic therapy in the field of peadiatric dentistry.

MATERIALS AND METHODS

The author reviewed the scientific literature to search for recommendations regarding the use of antibiotics to treat dental infections in children An electronic literature search was conducted in MEDLINE/PubMed, Cochrane and Google Scholar databases, including articles published between 2000 and 2022. MeSH terms used were: Anti-bacterial agents (D000900) and Pediatric Dentistry (D010377). A manual review of the cited literature was also performed. The basis for the work were the official EAPD, AAPD and IAPD guidelines.

RESULTS

The European Academy of Pediatric Dentistry [9], the American Academy of Pediatric Dentistry [10] and

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the International Association of Pediatric Dentistry [11] have issued official recommendations that indicate the rationale for medical practitioners regarding the use of antibiotics in paediatric dentistry. Before prescribing antibiotic therapy in a patient in developmental age, it is necessary to assess the individual's immunological response ability as well as the course and severity of the infection [5]. In general, indications for antibiotic therapy in pediatric dentistry include:

- acute infection with fever and severe pain

- infections spreading outside the oral cavity

- severe traumatic injuries involving extensive damage of soft tissues

- tooth avulsion

- selected forms of periodontitis, *e.g*. necrotizing-ulcerative gingivitis.

A detailed list of disease states requiring the use of antibiotics in children is presented in Table **1**.

It has been reported that in 30% of patients with compromised immune system, the bacteria present in the oral cavity, can be isolated also in the blood (*e.g*. *Enterococcus spp.; Staphylococcus epidermidis; Stentrophomonas maltophilia*). During anti-caner treatment, also viridans streptococci can be identified. In the blood of patients suffering from neutropenia and mucositis after chemotherapy, Gram (-), anaerobic bacteria can be found after dental procedures or during oral infection [5, 12]. For this reason, specific immunocompromised conditions were defined for which antibiotic prophylaxis is recommended:

- human immunodeficiency virus infection (HIV)

- immunodeficiencies regarding humoral or cellular response (*e.g*. SCIDS)

- chemotherapy

- state after bone marrow or vascularized organ transplantation

- radiotherapy in the head and neck region

- autoimmunological diseases (*e.g*. lupus erythematosus, juvenile arthritis)

- asplenia or state after splenectomy

- sickle cell disease

- chronic immunosuppression

- uncontrolled diabetes (particularly type 1)

- bisphosphonate curation [9].

Which antibiotic should the clinician choose?

Table 1: States Requiring the use of Antibiotics in Children Due to AAPD and EAPD

AAPD Reccomendations	EAPD Reccomendations
intraoral contaminated wounds*	bacteraemia following dental procedures in patients at risk of developing infective endocarditis*
open fractures*	bacteraemia following dental procedures in patients with prosthetic joint replacement (<2 years or immunodeficiency)
temporo-mandibular joint injury*	bacteraemia following dental procedures in patients with compromised immune system
acute facial swelling/ cellulitis of dental origin	acute infection with swelling, moderate/ severe pain and fever, progressing rapidly
tooth avulsion	Infection of any type and severity in medically compromised children
pediatric periodontal diseases associated with systemic conditions (*e.g*. congenital neutropenia, leukocyte adhesion deficiency, Papillon-Lefevre syndrome)	infection that has progressed to extraoral fascial spaces
acute bacterial salivary gland infections; juvenille recurrent parotitis	osteomyelitis
consider during staphylococcal mucositis, tuberculosis, gonococcal stomatitis, oral syphylis	tooth avulsion
	juvenile periodontitis

* Tetanus immunization status should be determined if there was a contact with the soil
* The American Heart Association recommendations should be checked

Amoxicillin is considered to be the first medicine of choice for treatment of dental infections in paediatric population, both alone or in combination with clavulanic acid. Amoxicilin is an often cause of allergic reaction, so taking proper medical history is required. It is effective against a wide variety of gram-positive bacteria and also some gram-negative species (in this case amoxicillin acts better than penicillin). A positive feature is the small amount of adverse effects, however adding the clavulanic acid can be connected with more side effects, such as diarrhoea or *Clostridium difficile* infection [13].

According to the AAPD recommendations [10], The American Heart Association discourages the use of clindamycin for prophylaxis against infective endocarditis due to dental procedures because of frequent and severe adverse effects which often involve community-acquired *C. difficile* infections. Instead of clindamycin, doxycycline is recommended, alternatively to penicillin, cephalosporin and macrolide allergy [14]. Tetracyclines are not allowed in children younger than eight years of age, as they can cause internal teeth discolorations, however there are some studies which indicate that their short-term use (less than 21 days) has not been a cause of such side effects in children under eight years [10, 15]. Cephalosporins can be an alternative to treat the orofacial infection in case of penicillin allergy or when a child has had previous course(s) of penicillin/amoxicillin [16]. Azithromycin is considered to be one of the safest antibiotics for allergic patients, on the other hand there can be some cardiac complications such as cardiotoxicity, which can be also connected with factors such as patient's age, gender, overall condition and a dosage of the antibiotic [10]. An addition of adjunctive antimicrobial agent, like metronidazole should be considered in case of severe infections involving anaerobic species [10].

The recommended dosage of selected antibiotics used in dental treatment in developmental age is presented in Table **2** [3, 9, 17].

DURATION OF ANTIBIOTIC THERAPY

The antibiotic therapy time should be as short as possible to heal the disease and prevent both clinical and microbiological relapse. The conventional minimal duration of antibiotic administration is five days ahead of the significant improvement of patient's condition (improved wound healing, reduction of erythema or swelling, reduction of signs and symptoms). Usually, 5 to 7 days of antibiotic therapy is prescribed in case of odontogenic infections, depending on the chosen agent [9, 10].

DISCUSSION

Acute oral infections in children can spread very rapidly and, if left untreated, be a cause of some serious complications. Because of the nature of odontogenic infections in children, antibiotics are frequently used drugs in pediatric dentistry. Using them in accordance with the indications and

Table 2: Antibiotics Dosage in Paediatric Dentistry

Clinical Situation	Antibiotic	Daily Dosage	Timing if Prophylaxis/ Treatment
No contraindications for amoxicillin	Amoxicillin	50 mg/kg bw (max 2g)	single dose 1h before procedure/ divided (every 12h)
Contraindications for amoxicillin			
No oral intake	Ampicillin (IM or IV)	50 mg/kg bw (max 2g)	single dose 1h before procedure/ divided (every 12h)
Allergy to penicillin	Cephalexin * Cefadroxil *	50 mg/kg bw (max 2g)	single dose 1h before procedure/ divided (every 8h)
	Azithromycin Clarithromycin	15 mg/kg bw (max 600 mg)	Single dose
	Doxycycline > 8-12 years of age	25-50 mg/kg bw	divided every 6h
	Clindamycin	20 mg/kg bw (max 600 mg)	single dose 1h before procedure/ divided (every 8h)
Oral infections with anaerobic bacteria	Metronidazole	20-30 mg/kg	single dose or divided (every 8h)

*cephalosporins should not be used in children with immediate-type hypersensitivity to penicillins (urticaria, angioedema, anaphylaxis)
mg/ kg bw = miligram/ kilogram body weight; IM – intramuscular; IV - intravenous

recommendations contributes to the patient's well-being, but there are clinical situations in which antibiotics are used inappropriately. Goel *et al*. [3] in their review indicate some examples of antibiotic misuse: use of an antibiotic that is too broad-spectrum for infections that can be treated by narrow-spectrum agent, administering antibiotics for viral infections, prescribing antibiotics instead of local operative treatment in requiring cases.

Aidasani *et al*. [19] performed a systemic review in which they cite situations of the proper use and the misuse of antibiotics, concerned about the phenomenon of bacterial resistance to the antibiotics. They report that increased prescription of antibiotics in paediatric dentistry was observed. However, very few studies cited in the review actually correlated this prescribing trend with bacterial resistance. No consensus regarding the duration of antibiotic therapy or prophylaxis was found in the cited studies. The article suggests that there is not enough evidence to determine a relation between the current prescribing trends of antibiotics in developmental age and the drug resistance. A solution to stop the increase in resistance may be shorter courses of antibiotics [3]. More randomized controlled trials should be performed on this subject. Inchara *et al*. [19] emphasize that, to improve standards of treatment, dental practitioners need to revise their knowledge of pharmacology in dentistry, pathogenesis of orofacial infections and mechanism of host's immunological response. Appropriate use of antibiotics is essential to provide safe care for the patients.

IAPD [11] provided some conclusions for clinicians to promote a proper use of antibiotics in peadiatric dentistry. Prescribing an antibiotic therapy, a pediatric dentist should remember:

- to choose the shortest cycle capable of preventing both clinical and microbiological recurrence (around three to five days beyond the full recovery and improvement of symptoms)

- to consider altering or discontinuing antibiotics following the determination of its ineffectiveness

- to refrain from antibiotic therapy if the infection is contained within the tooth or immediate surrounding tissues and have no signs of systemic infection or facial swelling

- that tetracyclines have limited use in paediatric dentistry (even up to 12 years of age)

- to consult with the pediatrician and evaluate the individual's susceptibility to infections, immune status, risks of dental procedure, choice of antibiotic, and the duration of antibiotic coverage.

CONCLUSION

Clinicians should regularly update their knowledge regarding antibiotic use in paediatric dentistry. Careful use of antibiotics is indicated to minimize the risk of developing bacterial resistance. Proper dosages of antibiotics should be administered. Prescribing antibiotics in generally healty children is of limited use.

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