

# Antibiotics in Pediatric Dentistry: A Double Edge Sword

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## ABSTRACT

Antibiotics are chemical substances that are capable of destroying and inhibiting the growth of specific microorganisms, such as infectious bacteria and fungi. The oral cavity is a complex biological ecosystem with very large number of microorganisms living in a biofilm. Antibiotics are commonly used in dentistry for prophylactic as well as for therapeutic purposes. Most often antibiotics are used in unwarranted situations, which may give rise to resistant bacterial strains. Good knowledge about the indications of antibiotics is the need of the hour in prescribing antibiotics for dental conditions. The purpose of this review article is to provide information on proper use of antibiotics in pediatric dental practice for control of oral infection, and in the management of children with systemic conditions which may alter disease resistance and healing response

**Keywords:** Antibiotics, Antibiotic Resistance, Prophylaxis, Paediatric Antibiotics

## INTRODUCTION

Antibiotics are the drugs which have truly revolutionized medical science by achieving adequate control of infections<sup>1</sup>. The word antibiotic was extracted from the word “antibiosis” a term in 1889 by Louis Pasteur which expedient a method by that life could be used to accustomed devast life. Alexander Fleming was the primary to discover the antibiotic however contrary to common belief, evidence of traces of antibiotics (tetracycline) dates back to the 350-550 CE wherever they were found in the human skeletal remains from ancient Sudanese Nubia<sup>3</sup>.

To manage a spread of oral diseases and conditions several medications are prescribed by the dentist. Most of those conditions are bacterial, fungal, and viral infections and pain. Antibiotics continue to be the most commonly prescribed drugs in children and adults<sup>4</sup> for prophylactic and therapeutic reasons. Prophylactic antibiotics are used to treat the diseases caused by the

oral flora introduced to distant sites in a host at risk or introduced to a local compromised site in a host at risk while Therapeutic antibiotics are used, in the cases, to treat diseases of the hard and soft tissues in the oral cavity after local debridement has failed<sup>5</sup>.

A series of differential characteristics are given in relation to antibiotic prophylaxis in pediatric patients<sup>6</sup>:

- Young kid tends to lack medical antecedents suggesting the possibility of drug allergies or adverse reactions.
- The bigger proportion of water within the tissues of kids, and their augmented bone sponginess facilitate quicker diffusion of infection. Thence adequate dose adjustment of the prescribed medication.
- The deficient oral hygiene found in most youngsters and also the consumption of sugar-rich foods contributes to extend the presence of microorganisms within the mouth and thereby

increasing the chance of bacteraemia following oral treatments.

The administration of medication to patients is more difficult by the requirement to regulate the dosages of medicines to accommodate their lower weight and body size<sup>7</sup>. Unreasonable antibiotics prescription has additionally been according in kids with orofacial infections. As medical specialty dentists, the notice of the definitive indications of antibiotics is obligatory. Once prescribed consequently, these medicines ought to be used as adjuncts to treat bound oral infections and stop serious things of pathology, Otherwise unsought problems like resistance might prove.

The purpose of this paper is to provide a review about the use of antibiotics in paediatric dentistry with special emphases on the use and consequences of misuse of antibiotics.

## MATERIAL AND METHOD

This paper reviews the current literature from the year 1997 to 2016. An electronic literature search was made in MEDLINE / PubMed, EBSCO host, and Google Scholar databases. MeSH terms used were: Antibacterial agents, Antibacterial agents and Pediatric Dentistry. The data was also compiled manually from comprehensive textbooks. Some recommendations were also acknowledged on the opinion of experienced researchers and clinicians.

## ANTIBIOTIC PROPHYLAXIS IN CHILDREN

Klein *et al.* in 2018, researched the trends of antibiotic consumption from 2000 to 2015 in 76 countries and projected total global antibiotic consumption through 2030. They concluded that between 2000 and 2015, antibiotic consumption, expressed in defined daily doses (DDD), increased 65% (21.1–34.8 billion DDDs), and the antibiotic consumption rate hiked 39% (11.3-15.7 DDDs per 1,000 Inhabitants per day)<sup>8</sup>.

Current dosage recommendation is usually based on the basal metabolism of

the child. Some formulas for calculation of the drug dose are:

Based on body weight (**Clark's formula**) – child dose = weight (kg)/70 × adult dose

Based on body surface area – child dose = body surface area (m<sup>2</sup>)/1.7 × adult dose

Based on age (**Young's formula**) – child dose = age of child/age + 12 × adult dose.]

The conditions which require antibiotic therapy in pediatric patients can be categorized as:

### A. Local infections

It includes all the odontogenic infections like tooth decay, infections, abscess, Facial swellings, Stomatitis, ANUG, Tooth Avulsion etc

### B. Systemic disease

Systemic conditions like diabetes, Renal Problems, Heart problems, Leukemia etc require special doses and special consideration for prescription.

Antibiotic prophylaxis is recommended for all dental procedures that involve manipulation of the gingival tissue or periapical region of the teeth or perforation of the oral mucosa, in patients with high-risk cardiac conditions. Antibiotics given are amoxicillin and ampicillin. When allergic to penicillin drugs given are cephalexin, clindamycin, azithromycin, clarithromycin and cefazolin.

Roberts GJ established that tooth brushing twice a day for one year protected a 1, 54,000 times increased risk of exposure to bacteremia than a single tooth extraction. If supplementary routine oral activities (such as chewing) are now added to this model, then the number hiked to 5.6 million times more than that resulting from a single tooth extraction<sup>9</sup>.

The choice of an antibiotic depends on the following factors<sup>10</sup>:

- A. Host issued factors: Age, Renal and hepatic function, Local factors
- B. Pathogen issued factors
- C. Drug issued factors: Spectrum of activity, Type of activity, Compliance by the patient, Cost consideration.

Types of antibiotic:

### **β-lactam Antibiotics**

β-lactam antibiotics are helpful and frequently utilised antimicrobial agents that share a common structure and mechanism of action of reducing the synthesis of the bacterial peptidoglycan cell wall. β-lactam antibiotics comprised Penicillins and Cephalosporins<sup>11</sup>.

#### **Amoxicillin**

Amoxicillin is an extended spectrum group of Penicillin. It became first available in 1972. It is on the one of the World Health Organization's list of Essential Medicines, the most effective medication needed in a basic health system. It is one of the most ordinarily prescribed antibiotics in children.

Amoxicillin is nimble against lot of gram positive and gram negative bacteria like Streptococcus, Bacillus subtilis, Enterococcus.

Therapeutic uses<sup>12</sup>:

- Dental prophylaxis in patients at risk of endocarditis (single dose)
- For the treatment of pulpal, periapical and periodontal infection.
- Upper respiratory tract infection due to Streptococci, Pneumococci and H. influenza
- Infection of skin and soft tissues due to streptococci

Pediatric dose<sup>12</sup>:

Children of 10 years > 40 kgs - 125– 250 mg every 8 hours

Children of 10 years < 40 kgs - 20 – 40 mg/kg daily in divided doses every 8 hours or 25 - 45 mg/kg daily in divided doses every 12 hours

Maximum dosage for Children: 2 g/day

Infants who are < 3 months old - Maximum of 30 mg/kg daily in divided doses

#### **Cephalosporins**

Cephalosporins were introduced in 1945 by the Italian pharmacologist Giuseppe Brotzu and were first marketed in 1964. They are indicated for the prophylaxis and treatment of infections for

children who are allergic to penicillin group of drugs<sup>12</sup>.

#### **Nitroimidazole**

Among all of the nitroimidazole commonly used in dentistry are 5-nitroimidazoles, metronidazole, imidazole and ornidazole<sup>12</sup>.

#### **Metronidazole**

Metronidazole was introduced in 1959 and is one of the mainstay drugs for the treatment of anaerobic and certain parasitic infection.

Therapeutic Uses<sup>12</sup>:

- Acute necrotizing ulcerative gingivitis (Vincent's Stomatitis)
- Pericoronitis and pericoronal abscess
- Chronic aggressive periodontitis
- Periapical and periodontal abscess

#### **Pediatric Dosage:**

30 mg/kg/day in 3 divided doses

Age of 7 - 10 years: 300 mg in three divided doses

Age of 3 – 7 years: 200 mg in three divided doses

Age of 1 – 3 years: 150 mg in three divided doses

Maximum dosage for Children: 2 g/day

#### **Antibiotic Combinations**

Antibiotic combinations have been used to control antibacterial activity against multiple potential pathogens for empirical treatment for critically ill patients. A combination of drugs also may have additive or super additive toxicities<sup>13</sup>.

#### **Amoxicillin and clavulanic acid**

Amoxicillin/Clavulanic acid combination was launched in United States in 1984 as an antimicrobial agent that enhanced the activity of Amoxicillin by the combination of the beta-lactamase inhibitor Clavulanic acid. During the last past 30 years this combination is being prescribed for a variety of pediatric infectious diseases<sup>14</sup>.

## PROBLEMS ASSOCIATED WITH ANTIBIOTIC

Overuse of antibiotics is becoming a major health problem causing antibiotic resistance especially in children. According to Dr Thomas J Pallasch<sup>15</sup> antibiotic misuse in dentistry mainly involves prescribing them in 'inappropriate situations' or for too long, which includes, giving antibiotics after a dental procedure is finished in an otherwise healthy patient for 'prevention' of an infection, which in all likelihood will not occur.

Nonclinical factors also contribute to the overuse of antibiotics, such as unavailability of close appointments, for the sake of seeking parental satisfaction; worried parents may sometimes complicate the problem by expecting antibiotics and putting pressure on dentists to meet their expectations<sup>16</sup>.

## CONCLUSION

Appropriate and proper use of antibiotics is important to confirm that effective and safe treatment is out there. Practices that will enhance microbial resistance ought to be avoided. Each dental should follow correct tips given by the Yank Association of Pediatric Medicine (AAPD) that relies on scientific proof to use antibiotics cautiously. The antibiotic medical care could be ambiguous brand, the misuse of which may be managed by its prudent use. Sir William Osler had justly quoted that the will to ingest medicines could be a primary feature demarcating animals from men. Hence, prescribing a dose of drug is in broad sense, prescribing or recommending a dose of one's information. Therefore, definite care should be taken whereas prescribing any antibiotic as "an acceptable action these days will assure an efficient cure for tomorrow".

### Declarations

**Ethics approval and consent to participate:** Not Applicable

**Consent for publication:** Not applicable

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**1<sup>st</sup> author: Dr. Raghavendr Singh** – He conceived and designed the format of the article. The collection of the data and analysis of the data was also performed by him.

**2<sup>nd</sup> author: Dr. Medha Lakhanam** - The compilation of all the collected data and editing process was performed by the second author.

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