REVIEW ARTICLE

Antimicrobials: their use and misuse in pediatric dental practices

Shruti Verma[1], Nida Naim[1], Sushmita Kumar[1], Medha Sinha[1], Surbhi Agarwal[2]

ABSTRACT

Antimicrobials are chemical substances that are capable of knocking down and hampering the growth of specific microorganisms, such as infectious bacteria and fungi. The oral cavity is a complex biological ecosystem with abundant microorganisms living in a biofilm. Different species of the microorganisms are of low virulence, but together they are pathogenic. Antimicrobials are frequently put to use in dentistry for therapeutic purposes. Most often, antibiotics are used in indefensible scenarios, which may give rise to resistant bacterial strains. Dental professionals want to make their patients well and prevent unpleasant complications. These impulses, along with the belief that many dental problems are infectious, prompt the prescribing of antibiotics and the usage of other antimicrobials.

Keywords: Pediatric dentistry, antimicrobials, antibiotics, microorganisms

INTRODUCTION

According to the WHO, the misuse of antibiotics is a global issue. The oral cavity is home to a huge number of microorganisms that together form a sophisticated biological environment.

Continuous interactions between the bacteria promote a switch from anaerobic to aerobic metabolism, which frequently results in pulpal and periodontal illnesses. Dentistry's primary goal is to manage dental diseases brought on by microbial activity and to return the tooth to its ideal state of form and function. While the improper use of antibiotics causes certain bacterial species to become more resistant to treatment[1].

HISTORY

Antibiotics can be unanimously considered drugs that have truly revolutionized healthcare by achieving adequate control of infections. In light of this increasing prescription trend, the worldwide problem of antibiotic resistance is a cause for concern. In fact, this threat has been aptly referred to as a 'ticking time bomb' requiring immediate measures[2]. This phenomenon, associated with mutational or genetic changes within the bacterial strains under selective pressure, has inevitably been associated with increased consumption of these medicines. Also, concurrently with antibiotic resistance, the incidence of side effects and hypersensitivity reactions along with superinfections has been commonly documented with antibiotic usage[3,4].

1. *Post-graduate student,*
2. *Professor*

Department of Pedodontics & Preventive Dentistry

Correspondence Address

Dr. Shruti Verma

Department of Pedodontics & Preventive Dentistry, Kothiwal Dental College and Research Centre, Moradabad Uttar Pradesh, India

In fact, recently, an indirect link has been discovered between the early use of antibiotics in childhood and the likelihood of having allergic asthma[5].

When prescribed systemically, these drugs should be used as accompaniments to treat certain oral infections or for prophylaxis to prevent serious situations of bacteraemia[6]. Otherwise, undesirable issues like resistance may ensue. Abuse by the patient or the parent and inefficient usage can also lead to this problem[7].

CONDITIONS IN PEDIATRIC PATIENTS THAT MOSTLY REQUIRE ANTIBIOTICS-

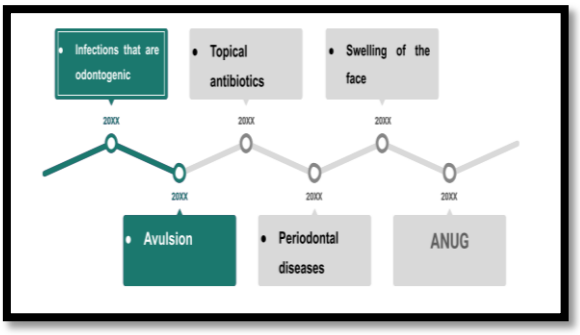

Fig 1- Conditions in Pediatric patients that require antibiotics.

- **Infections that are odontogenic**
- **Topical antibiotics**
- **Swelling of the face**
- **Avulsion**
- **Periodontal diseases are a type of gum disease that affects the teeth and gums.**
- **ANUG** is frequently linked to systemic side effects such as fever and malnutrition. (Fig 1)

IN PEDIATRIC PATIENTS, CONDITIONS THAT DO NOT REQUIRE THE PRESCRIPTION OF ANTIBIOTICS

Fig 2- Conditions in Pediatric patients that do not require antimicrobials.

- Minor adversities: Antibiotics are not recommended in the event of minor injuries.
- Pulpitis: The 2009 American Academy of Pediatrics (AAPD) recommendation states that treatment (pulpotomy, extraction, or pulpectomy) should be carried out if a child exhibits acute pulpitis symptoms. Third molar instances with pulpal involvement should follow antimicrobial prophylaxis[8].
- Tooth eruption and exfoliation: There is no evidence to suggest that antibiotics are necessary at this time[9]. (Fig 2)

The improper use of antibiotics in dentistry is one issue that could be a contributing cause. Dr. Thomas J. Pallasch[10] claims that antibiotic misuse in dentistry primarily involves prescribing them in "inappropriate situations" or for too long, which includes giving antibiotics to a patient who is otherwise healthy after a dental procedure is finished to "prevent" an infection that is almost certainly not going to happen (Fig 3).

Fig 3- Clinical conditions of unnecessary use of antibiotics.

Dentists want their patients to be healthy and avoid unpleasant side effects. These objectives, together with the notion that many oral health issues are contagious, influence the recommendation of antibiotics[11].

PRESCRIPTION TRENDS IN PEDIATRIC DENTISTRY

Cross-sectional surveys and studies conducted nationwide or geographically to figure out the pattern of antibiotic prescription were used to gather the majority of the evidence addressing the prescribing behaviour of antibiotics in pediatric dentistry. According to a comprehensive analysis of prescribing practices, dental professionals account for 7–11% of the world's total antibiotic use[12]. This shows that although general practitioners and pediatricians are the main global contributors to the problem of antibiotic resistance, pediatric dentists have also made some contributions [Rapkin, 1997].

Literature Reviews of prescribing trends of antimicrobials in pediatric dentistry

In the majority of investigations, prudent antibiotic use was only taken into account after a few consistent findings. These included prescribing antibiotics in response to any type of systemic infection spread indication, such as face edema or a radiographically visible pathology.

One of the first studies to successfully conduct a large-scale survey of practicing dentists for the youth dental population in North Carolina was one by Cherry et al. [2012]. The American Academy of Pediatric Dentistry (AAPD) recommendations were clearly not being followed (10-42%), and this behaviour tended to be worse on weekends (14-17%). A significant survey of 100 dentists and 100 pediatric dental experts conducted in India indicated a noteworthy conclusion that pediatric dentists demonstrated statistically significant higher adherence to the recommendations than general dental practitioners.

To assess the overprescription of antibiotics for prophylaxis, a study conducted in Brazil revealed not only incorrect usage of the drug but also an inappropriate prescription in terms of the chemical name of medicines, their dosage, and the duration of antibiotic therapy[13]. Another important study assessed the pattern of antibiotic use among the members of AAPD. These studies disclosed an engrossing deduction: none of these studies, reviews, or surveys inspecting for prescribing practices showed the use of antimicrobial sensitivity testing or microbial culture reports prior to the actual antibiotic prescription[14].

Factors associated with the prescribing trends

Overprescription in non-indicated situations like irreversible pulpitis, dentoalveolar abscesses with localized abscesses, simple traumatic conditions of intrusion, and extrusion were observed in these studies. It can be concluded that symptomatic conditions of pain and inflammation dictate the use of antibiotics rather than actual infections.

A special cause of the observed prescribing behaviour in reference to pediatric dentistry could be the pressure or requirements of the parent and the patient. This parental pressure has been reported as one of the main causes leading

to unwarranted prescription [Dar-Odeh et al., 2010; Wong et al., 2016]. Studies suggest that practitioners assume that using antibiotics is the quickest way to resolve any form of consultation[15]. The compilation of these barriers of knowledge, attitude, and external factors is accountable for the observed prescribing trends[16].

GUIDELINES FOR ANTIBIOTIC USAGE IN PEDIATRIC DENTISTRY

Lack of standards for the precise usage and indications of these medications in pediatric dentistry may be one of the main causes of the overprescription and abuse of antibiotics. In order to ensure the proper use of these medications, various countries around the world have developed their own guidelines. These include the Scottish Dental Clinical Guidelines, the American Dental Association, the Canadian Dental Association, and the National Institute of Health and Care Excellence-United Kingdom (NICE) guidelines, among others. However, the AAPD's recommendations are the only ones that address the use of antibiotics in the pediatric dentistry population[17].

Antibiotic selection

Oral antibiotics such as penicillin, clindamycin, erythromycin, cefadroxil, metronidazole, and the tetracyclines are effective against odontogenic infections. Penicillin V is the penicillin of choice. It is a bactericidal with a limited spectrum of action and appropriate for treating odontogenic infections. Amoxicillin is the antibiotic of choice for the prophylaxis of endocarditis associated with dental treatments. Amoxicillin with clavulanic acid (clavulanate) can be used in certain cases, as it offers the advantage of preserving activity against the beta lactamases commonly produced by microorganisms associated with odontogenic infections[18]. Clindamycin is an alternative in the case of patients who are allergic to penicillins. If a child is allergic to penicillin, then the latest generation macrolides, clarithromycin, and azithromycin, can also be used. Cephalosporin and cefadroxil are additional options when a broader spectrum of action is required. Metronidazole is characteristically prescribed in situations where only anaerobic bacteria are suspected. Tetracyclines can cause changes in tooth colour, they must not be administered to children under eight years of age, or pregnant or nursing women[19].

PREVENTION OF EARLY CHILDHOOD CARIES (ECC) BY ANTIMICROBIAL THERAPY

According to earlier research, ECC is microbiologically distinguished by a thick microbial dental infection. Studies on animals and people show that the development of MS occurs prior to the start of dental caries and is linked to frequent and extended ingestion of cariogenic substrates. These experimental findings are consistent with the hypothesis that caries-promoting foods and MS colonization in newborns will result in a sharp rise in oral MS populations. Such an increase carries a significant risk of widespread dental cavities. On the basis of this, it is conceivable that suppressing MS to non-pathogenic levels may reduce the likelihood that ECC will develop.

In children who are at high risk of developing ECC, topical antibiotic therapy dramatically increases disease-free survival, according to experimental findings from the clinical trial carried out by Lydia Lopez et al. If this impact persists after the antimicrobial agent is stopped using, it would be crucial to know. Due to this, larger and more thorough clinical trials are required before 10% povidone iodine therapy is used in clinical settings as a preventive measure for ECC[20].

EFFECT OF ANTIMICROBIAL INTERVENTION ON THE ORAL MICROFLORA ASSOCIATED WITH EARLY CHILDHOOD CARIES

Since 1998, numerous antimicrobial clinical trials or intervention programs have been carried out globally in an effort to eradicate cariogenic bacteria and lessen the incidence of childhood caries. Fluoride, chlorhexidine, iodine, xylitol, and silver compounds, along with a variety of application techniques (such as mouthwash, gel, varnish, cleaning wipes, and restorative materials), have all been used to great effect in reducing the levels of S. mutans and S. sobrinus. The majority of the beneficial effects, however, vanished after a few weeks or months of the intervention, and when the treatment was stopped, the declines in S. mutans and S. sobrinus colonization were lessened.

MEASURES TO COUNTER ANTIMICROBIAL RESISTANCE IN DENTISTRY

To check antimicrobial resistance, every physician must know how to use antibiotics by defining them meetly and educating their cases and associates on the proper use of this introductory but decreasingly limited medical resource. Judicious use of antibiotics in dentistry relies on proper diagnosis and prescribing antibiotics only when needed and is based on the following principles: Defining the most applicable medicine at the correct cure, by the proper route of administration, and for the most applicable duration. Among the measures introduced by the World Health Organization to promote the conscious use of antibiotics is the new bracket of these medicines into three groups with the acronym apprehensive (Access, Watch, and Reserve) [21] (Fig 4).

Fig 4- (AWaRe) New classification of antibiotics according to WHO.

The first group, Access, includes all antibiotics that offer the remedial benefit with the smallest eventuality for resistance. The second group, Watch, comprises the agents prone to selective resistance. The third group, Reserve, consists of all those antibiotics, such as meropenem, that should be used little, especially in those microorganisms that have developed multiresistance[22]. Additionally, the WHO experts advise adopting the acronym MIND ME as a memory aid to assist dentists and doctors in remembering the elements of excellent antimicrobial stewardship (Fig 5).

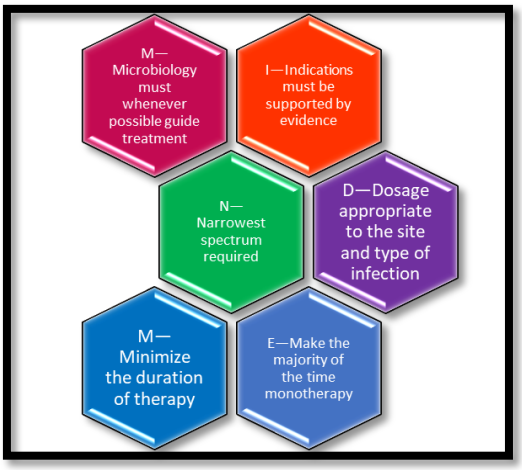

Fig 5- (MIND ME) Memory Aid for dentists to remember the elements of excellent antimicrobial stewardship.

It starts with a thorough clinical evaluation that involves gathering the patient's medical history and conducting an unbiased examination. The next step is to decide whether additional diagnostic testing is required before deciding on the patient's course of treatment. In this scenario, it has been recognized that it is necessary to control the phenomenon of antimicrobial resistance by promoting coordinated interventions in different areas[23] (Fig 6).

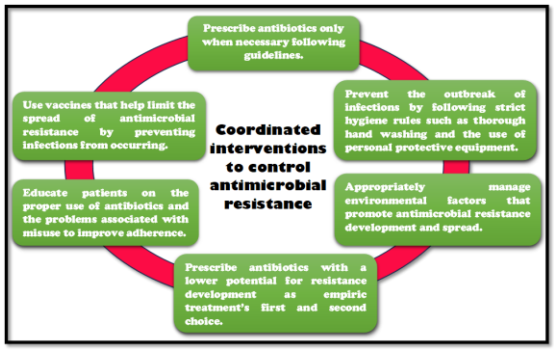

Fig 6- Coordinated interventions to control antimicrobial resistance.

CONCLUSION

The safe use of antibiotics has modernized the treatment of a number of diseases. The use of antibiotics, both systemic and topical, is common in dental treatment, particularly for patients with pain or swelling. The use of dental agents consisting of antibiotics should be carefully monitored in order to avoid bacterial resistance. The dental profession has an obligation to limit the use of antibiotics to situations that actually require them and to situations where patients will benefit from their use.

A significant proportion of antibiotics prescribed for acute dental diseases and prophylaxis are unnecessary and inappropriate, leading to antibiotic overuse and misuse, increased bacterial resistance, and associated adverse outcomes. Antibiotics should only be specified in clinical situations taking empiric antibiotic remedy and not for all odontogenic infections, and systemic antibiotics are recommended only for specific situations.

Preventing bacterial endocarditis and surgical site infections are the two main reasons for antibiotic prophylaxis in dentistry. The main factor promoting the emergence of antibiotic-resistant microbes is improper antibiotic prescription, however, other reasons might cause good practice to be neglected. In fact, every doctor needs to be knowledgeable about how to administer antibiotics safely and instruct their patients and colleagues.

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