ANTIBIOTICS IN DENTISTRY- A SHORT REVIEW

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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. The indications for use of antibiotics in dentistry are limited and specific. There are around 50 million bacteria in every gram of surface soil, a few bacteria can be dangerous to our health by causing infections and even death. Antibiotics can have "broad" or "narrow" spectrum – Broad spectrum are active against many different types of bacteria and Narrow spectrum are active against one or a few types of bacteria. Antibiotics have selective toxicity toward the bacterium rather than the host.

Keywords: Antibiotic, Pharmacology, Dentistry, Epidemiology

INTRODUCTION

The oral cavity is a complex biological ecosystem with very large number of organisms living in a biofilm. The interaction of the organisms are complex and the change from health to disease state is associated with a change in the balance of the ecosystem usually from the resident facultative anaerobes to obligate anaerobes for most pulpal and periodontal disease. The term antibiotic referred to drugs produced by living micro organisms like bacteria or fungi. They have natural metabolism, but chemotherapeutic are only artificial prepared antimicrobial agents.

Mostly all natural antibiotic used today are chemically modified to improve the pharmacokinetic properties, making the distinction between antibiotics and chemotherapeutic agents obsolete. Use of antibiotics in dental practice is characterized by prescription based on clinical and bacteriological epidemiological factors, with the use of broad spectrum antibiotics for short periods of time, and the application of a very narrow range of antibiotics.

Antibiotic treatment is an aspect of pharmacotherapy with the particularity of affording both etiological and curative action. These drugs were introduced in the mid-twentieth century in the form of sulfa drugs (1935), penicillin (1941), tetracyclines (1948) and erythromycin (1952). Antibiotics have focused much clinical and pharmacological research, in response to the progressive challenges posed by bacterial infections: identification of new pathogens, the development of resistances to antibiotics, the consolidation of new diseases.

Most dental pain is the result of infection induced inflammatory process in a closed compartment as in the pulp and the apical periodontal region or in sensitive and highly innervated soft tissue like the periosteum space, gingiva and periodontium.Antibiotics are prescribed in dental practice for the following purposes: (a) treatment for acute odontogenic infections; (b) treatment for non-odontogenic infections; as prophylaxis against focal infection in patients at risk (endocarditis and joint prostheses); and as prophylaxis against local infection and systemic spread in oral surgery. Rational antibiotic use is thus required in dental and oral clinical practice, to ensure maximum efficacy while at the same time minimizing the side effects and the appearance of resistances [1].

Dentists prescribe medications for the management of a number of oral conditions, mainly orofacial infections. Antibiotic prescribing may be associated with unfavorable side effects ranging from gastrointestinal disturbances to fatal anaphylactic shock and development of resistance. The increasing resistance of drugs in the recent years are probably related to over- or misuse of broad-spectrum agents such as cephalosporins and fluoroquinolones.[2]

The little or no evidence supporting antibiotics use in many dental applications, and the presence of some data from clinical trials contraindicating their use, makes the decision to prescribe empirical. Although the dangers of the misuse of antibiotics, in particular, the emergence of resistance, have been known for decades, increased public awareness to the consequences of misuse of antibiotics is still necessary. Antibiotics are prescribed for oral conditions related to many specialties, particularly oral surgery. The antibiotic prescribed most frequently is penicillin or an analog like amoxicillin especially. Most dentists are familiar with penicillin's low toxicity, dosages and relatively low cost [3].

Antibiotics are regularly prescribed by dentists for the management of oral and dental infections. Unfortunately their value is being jeopardized by the presence of microorganisms resistant to their effects [4].

The definitive indications for use of antibiotics in dentistry are limited and specific. This review discusses the various principles and rationale behind antibiotic therapy in different fields of dentistry with stress on rational antibiotic use in dentistry. An important consideration in starting antimicrobial therapy is to assess if the infection is localized and if the patient has an adequate immune response to control the bacteria if supported surgically.

Classification of antibiotics

There are several ways of classifying antibiotics but the most common classification schemes are based on their molecular structures, mode of action and spectrum of activity. Others include route of administration (injectable, oral and topical). Antibiotics within the same structural class will generally show similar pattern of effectiveness, toxicity and allergicpotential side effects. Some common classes of antibiotics based on chemical or molecular structures include Beta-lactams, Macrolides, Tetracyclines, Quinolones, Aminoglycosides, Sulphonamides, Glycopeptides and Oxazolidinones [5], classification based on mechanism of action that include Affecting Protein Synthesis, Affecting on Nucleic acid synthesis, Antimetabolite antimicrobials, Acting on Cell wall, Acting on Cell membrane

Antibiotics mode of action

The antimicrobial potency of most classes of antibiotic are directed at some unique feature of the bacterial structure or their metabolic processes. The mechanism of antibiotic actions are as follows: Inhibition of cell wall synthesis, Breakdown of cell membrane structure or function, Inhibition of the structure and function of nucleic acids, Inhibition of protein synthesis, Blockage of key metabolic pathways.

Table 1: Antibiotics recommended for various dental treatments according to the specialization [6]

S. NO.	SPECIALITY	RECOMMENDED	NOT RECOMMENDED
1	Oral surgery	Dental extractions Minor oral surgery Intraligamentary LA injection	Suture removal Routine LA injection
2.	Periodontics	Subgingival scaling Root planning Periodontal surgery	Supragingival scaling
3.	Conservative & Endodontics	Periapical endodontic procedures Reimplantation of avulsed tooth	Restorative treatment Intracanal endodontic therapy Rubber dam application
4.	Prosthodontics	Dental implant replacement	Impression taking Removable prosthetic appliances
5.	Orthodontics	Initial placement of orthodontic bands but not brackets	Placement of removable orthodontic appliance Orthodontic appliance adjustment
6.	Pedodontics	Primary tooth extraction Pulpotomy Pulpectomy	Shedding of primary teeth Fluoride treatment

Antibiotics are also commonly indicated in dental practice for treating immunocompromised patients, patients with evident signs of systemic infection and if the signs and symptoms of infection progress rapidly [7].

Antibiotic prophylaxis recommendation [8]

Situation	Agent	Regimen*
Standard general prophylaxis	Amoxicillin, Cephalexin**, or Cephradine	2.0g orally 30-60 minutes before procedure
Unable to take oral medications	Ampicillin Cefazolin	2.0g IM or IV 30-60 minutes before procedure 1.0g IM or IV 30-60 minutes before procedure
Penicillin-allergic	Clindamycin	600 mg orally 30-60 minutes before procedure
Penicillin-allergic and unable to take oral medications	Clindamycin	600 mg orally 30-60 minutes before procedure

*no follow up dose recommended

** Cephalosporins should not be used in individual with immediate type hypersensitivity reaction to penicillin

Prevention of antibiotic resistance

Consumption of antibiotic in humans is increasing worldwide. The emergence of antibiotic-resistant bacteria within the oral flora will have an impact on the prescribing of antibiotics in dentistry. The relationship between antibiotic usage and development of antibiotic resistance is highly multifaceted. In the pretext of Self medication, it is mandatory that the national governments show interest in this issue and formulate proper healthcare policies to combat the problem and regulate responsible self medication. The general population should also be educated about the appropriate use, advantages and limitations of the common antibiotic drugs that are used most commonly in general. Increased awareness and education in society to be created to prevent or minimize the patients taking Self-medication which is considered as an important cause of antibiotic resistance [9].

Policy-makers need to consider the interplay between systemic, provider, dispenser and consumer factors in order to address the serious concern. An education campaign for health providers, pharmacists and the public around the risks of inappropriate use of antibiotics is warranted [10].

Consideration for chemoprophylaxis in some systemic conditions, Bacteremia occurs whenever there is manipulation of gingival tissue, integrity of the mucosal barrier is breached during endodontic instrumentation, this is potentially dangerous in patients with prosthetic cardiac valves or untreated cardiac valve/septal defects and in patients with allograft prosthetic joints. The indications for infective endocarditis prophylaxis are constantly being revised. Recent guidelines for antibiotic prophylaxis in patients with prosthetic joints has been issued which also recommends against the routine practice of antibiotic prophylaxis in these patients due to in sufficient evidence for linking dental procedures to periprosthetic infections. [11]

Systemic antibiotics in the treatment of periodontitis

The recognition of the microbial origin and specificity of periodontal diseases in the late 1970s led to an increased interest in the use of antimicrobial agents in periodontal therapy to promote a selective suppression of the probable etiologic agents.

Prophylactic antibiotic prescribing

Prophylactic antibiotics, taken prior to a number of dental procedures, have been advocated to reduce the likelihood of postoperative local complications, like infection, dry socket, or serious systemic complications like infective endocarditis. The evidence for antibiotics acting to prevent infection from surgical wounds in the mouth is poor to non-existent, indicating that preoperative parenteral antibiotic prophylaxis for routine third molar surgery in medically fit patients is unwarranted. [12]

Evolution of prophylaxis guidelines, Differing protocols have been published over the years regarding antibiotic prophylaxis for dental treatment of patients with prosthetic joints. The recommended intervals during which prophylaxis should be given have ranged from the first three months to the first two years after joint replacement.[13]

Dosages in pediatric patients

Current dosage recommendation are usually based on the basal metabolism of the child. Some formulas for calculating drug dosage are:27 Based on body weight (Clark's formula) – child dose = weight (kg)/70 × adult dose Based on body surface area – child dose = body surface area (m2)/1.7 × adult dose Based on age (Young's formula) – child dose = age of child/age + 12 × adult dose.[14]

Duration of antibiotic therapy

The ideal duration of antibiotic treatment is the shortest cycle capable of preventing both clinical and microbiological relapse. Most acute infections are resolved within 3 to 7 days. When oral antibiotics are used, a high dose should be considered to secure faster therapeutic levels.[15]

Discussion

Antibiotics are chemical substances that are capable of destroying and inhibiting the growth of specific microorganisms, such as infectious bacteria and fungi. There are different antibiotics, which are broadly classified based on their mechanism of action (i.e. if on the cell membrane, cell wall, or metabolism), chemical structure, spectrum of activity (i.e. if targeting gram negative or gram-positive bacteria), or by mode of administration (e.g. oral, intravenous, or topical).[16]

Conclusion

There are world-wide efforts that look for strategies to deal with the challenge of growing antimicrobial resistance. Antibiotics saved countless lives and made modern medicine possible. The antibiotic drugs are miracle life saving drugs only when used properly. Dental patients not only pressure their dentist to get an antibiotic prescription, they also self-medicate. Selfmedication with antibiotics was found to be alarmingly high in some developing countries. The antibiotics are associated several fatal complications if they are used improperly. Hence, the dental surgeon should know how to use these miracle drugs properly. The proper use of antibiotics is related to the principles of infection management, microbiology of infectious agent and host response, and the pharmacology of the particular agent. In the clinical setting, these principles are modulated by a number of factors. These factors need to be understood to ensure appropriate prescribing of antibiotics.

REFERENCES

1. Rafael Poveda Roda, Jose Vicente Bagan , Jose Maria Sanchis Bielsa ,Enrique Carbonell Pastor , Antibiotic use in dental practice. A review, Med Oral Patol Oral Cir Bucal. 2007; 12:E186-92.
2. Wise R, Hart T, Carrs O, *et al*., Antimicrobial resistance is a major threat to public health. BMJ. 1998;317:609–610.
3. Michael CA., et al. "The antimicrobial resistance crisis: Causes, consequences and management". Frontiers in Public Health 2 2014: 145.
4. 4.Cohen FL & Tartasky U, Microbial resistance to drug therapy: A review, Am J Infect Control. 1997;25:51-64.
5. Ebimieowei Etebu1 and Ibemologi Arikekpar, Antibiotics: Classification and mechanisms of action with emphasis on molecular perspectives, IJAMBR . 2016: 90-101
6. Amit kumar, megha singh, ajay gupta .Prophylactic use of antibiotics in dentistry – A review. Ijocr. 2014; 2(5):36-40.
7. Henry M, Al R, Beck M. Effect of Penicillin in postoperative endodontic pain and swelling in symptomatic necrotic teeth. J Endod. 2001; 27: 117–123.
8. Suchi K and Praveen J. Antibiotics in Dentistry – A Boon or Bane, J Dent App. 2015:2(1): 132-137.
9. Darshana Bennadi. Self-medication: A current challenge J Basic Clin Pharm. December 2013-February 2014; 5(1): 19–23.
10. Gillian Porter, Nathan Grills. Medication misuse in India: a major public health issue in India Journal of Public Health. 2016; 38(2):e150–e157.
11. Dr.Akilesh Ramasamy. A Review Of Use Of Antibiotics In Dentistry And Recommendations For Rational Antibiotic Usage By Dentists. The International Arabic Journal of Antimicrobial Agents.2014; 4: 2:1.
12. Najla Saeed Dar-Odeh,1 Osama Abdalla AbuHammad,1 Mahmoud Khaled Al-Omiri, Ameen Sameh Khraisat, Asem Ata Shehabi. Antibiotic prescribing practices by dentists: a review,Therapeutics and Clinical Risk Management. 2010:6 301–306.
13. Uckay I, Pittet D, Bernard L, Lew D, Perrier A, Peter R. Antibiotic prophylaxis before invasive dental procedures in patients with arthroplasties of the hip and knee. J Bone Joint Surg Br 2008;90-B:833-8.
14. Ashok Agarwal, Sunil R Panat, Anshul, Anuraag Gurtu, Ashish Aggarwal. Antibiotic usage in Pediatric Dentistry: A Comprehensive Review. Journal of Dental Sciences and Oral Rehabilitation, July-September 2014;5(3):125-132.
15. Peedikayil FC. Antibiotics: use and misuse in pediatric dentistry. J Indian Soc Pedod Prev Dent. 2011;29(4):282-287.
16. K.D Tripathi. Text book of Essentials of Pharmacology for Dentistry. IST edition Jaypee Brothers Medical Publishers (p) ltd. 2005:354-368.