

The Role of Antibiotics in Treatment of Chronic Periodontitis

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Abstract Systemic antibiotics may be a necessary adjunct in controlling bacterial infection because bacteria can invade periodontal tissues, making mechanical therapy alone sometimes ineffective. An ideal antibiotic for use in prevention and treatment of periodontal diseases should be specific for periodontal pathogens, allogenic and nontoxic, substantive, not in general use for treatment of other diseases, and inexpensive. Combination of antibiotics may be necessary to eliminate all putative pathogens from some periodontal pockets. The guidelines for use, structure and origin, mechanisms of action of antibiotics are discussed in this paper. Also the recommended antibiotic dosages in Periodontal therapy is reviewed in this paper.

Keywords: plaque, virulence, micro organisms, antimicrobials, bacteria

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1. Introduction

The microbial etiology of inflammatory periodontal diseases provides the rationale for use of antibiotics in periodontal therapy. Successful prevention and treatment of periodontitis is contingent upon effective control the periodontopathic microbiota.

There is a wide agreement on the etiological role of bacteria in human periodontal disease. Bacteria exhibit different properties when contained within a biofilm. A wide variety in the composition of the subgingival microflora had been seem to be associated with periodontal disease (van Winkelhoff and de Graaff 1991) [1]. Different types of bacteria are associated with different forms of periodontal disease. The identification of pathogen(s) of an infectious disease, including periodontal diseases, leads inevitably to the question "how do these organisms cause the disease?" the answer is the virulence factors. Analysis of the potential *virulence factors* produced by oral species including periodontal pathogens is a very active area of research. Virulence is generally defined as the relative ability of an organism to cause disease or to interfere with a metabolic or physiological function of its host. It's the ability of a microbe to express pathogenicity (e.g., virulent), which is contrasted with non pathogenic or avirulent organisms. Virulence is a complex interaction between the microbe and its host and is dependent upon many extrinsic factors of the environment. The ability of the organism to cause a disease depends upon the characteristic end products of

bacterial metabolism, the chemical composition of bacterial components and its ability to overwhelm host [2].

Antibiotics are a naturally occurring, semisynthetic or synthetic type of antimicrobial agent that destroys or inhibits the growth of selective microorganisms, generally at low concentrations.

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An ideal antibiotic for use in prevention and treatment of periodontal diseases should be specific for periodontal pathogens, allogenic and nontoxic, substantive, not in general use for treatment of other diseases, and inexpensive. Combination of antibiotics may be necessary to eliminate all putative pathogens from some periodontal pockets [3].

Several criteria must be met before the use of antibiotics can be justified. These are that:

1. The nature of bacterial flora associated with periodontal disease must be amenable to control by antibiotics.
2. Antibiotics must be shown either to be superior to traditional clinical treatment in controlling the disease or to act as useful adjuvant to it.
3. Antibiotics used must be free from adverse side effects and from the induction of hypersensitivity or bacterial resistance.
4. Antibiotics must achieve effective concentration in periodontal pockets where the causative bacteria reside.

2. Guidelines for Use of Antibiotics in Periodontal Therapy

1. The clinical diagnosis and situation dictate the need for possible antibiotic therapy as an adjunct in controlling active periodontal disease.
2. Continuing disease activity, as measured by continuing attachment loss, purulent exudates, and/or continuing periodontal pockets of ≥ 5 mm that bleed on probing, is an indication for microbial analysis and further periodontal therapy.
3. When used to treat periodontal disease, antibiotics are selected based on the microbial composition of the plaque, the patient's medical status and the current medications.
4. Microbiologic sampling is performed according to the instructions of the reference microbiologic laboratory. The samples are taken at the beginning of an appointment before instrumentation of the pocket.
5. Plaque sampling can be performed at the initial examination, root planning, reevaluation, or supportive periodontal therapy appointment. Clinical indications for microbial testing include aggressive forms of periodontal disease, diseases refractory to standard mechanical therapy, and periodontitis associated with systemic conditions.
6. Antibiotics have been shown to have value in reducing the need for periodontal surgery in patients with chronic periodontitis.
7. Antibiotic therapy should not be used as a monotherapy it must be part of the comprehensive periodontal treatment plan.
8. Slots and co-workers have described a series of steps using antimicrobial agents for enhancing regenerative healing. They recommended starting antibiotics 1 to 2 days before surgery and continuing for a total of at least 8 days [4,5].

3. Antibiotics of Interest to Dentists are Classified According to Their Structures [6]

1. Beta-lactams: These contain a β -lactam ring nucleus, and include the penicillins, cephalosporins and cephalomycins.
2. Tetracycline: These all have a four ringed structure, and their names end in cycline.
3. Azoles: These all contain an azole ring, and their names end in azole (e.g. Metrodinazole).
4. Macrolides: e.g. Erythromycin.
5. Sulphonamides: The names of this group contain sulpha or sulfa.
6. Aminoglycosides: These are either derived from various species of streptomyces fungi and end in mycin (e.g. gentamycin & amikacin).
7. Quinolones: These are all structurally related to nalidixic acid and most end in oxacin e.g. ciprofloxacin.

4. The Structure and Origin of Antibiotics [7]

A variety of techniques have been used to determine the chemical structure of naturally produced antibiotics, and the detailed structure of most of these is now known.

4.1. Gentamycin is an aminoglycoside antibiotic produced by *Micromonospora purpura* [8].

4.2. Tetracycline (Chambers and Sande, 1996; Laurence et al 1997) is produced by species of *Streptomyces*. It has a four-ringed parent structure and a family of tetracyclines has been produced by altering side chains [9].

4.3. Penicillin originates from the *Penicillium* fungus, but since the structure of its nucleus was determined many new penicillins have been synthesized. This has vastly increased the antibacterial range of these antibiotics and increased their adsorptions from a variety of routes. This has been achieved by adding appropriate side chains to the β lactam nucleus [10].

4.4. Metronidazole is a benzimidazole which was synthesized for use as an anti helminthic agent. Its action against anaerobic bacteria was discovered as a result of its administration to a patient with a trichomonal vaginitis who was also suffering from oral acute necrotizing ulcerative gingivitis (ANUG). It was found to bring about a swift resolution of the ANUG. It has been shown to be active against most strictly anaerobic bacteria [11].

4.5. Erythromycin is a macrolide antibiotic with a complex structure produced by species of *Streptomyces* [12]. Clindamycin is produced by the soil bacterium *Bacillus fragilis* [13].

4.6. Vancomycin is a complex tricyclic glycopeptide, and its structure has only recently been chemically determined [14].

5. Mechanism of Action of Various Antibiotics

For the purpose of organization, different classes of antibiotics have been divided into categories based on their bactericidal and bacteriostatic effect on various structures or macromolecules associated with bacterial cell [15,16]. These include:

1. Inhibition of cell wall synthesis (penicillins and cephalosporins).
2. Interference with the cell membrane.
3. Inhibition of protein synthesis (tetracyclines, macrolides and clindamycin).
4. Interference with nucleic acid synthesis (metronidazole and quinolones).
5. Antimetabolite activity (Sulfonamides and Dapsone).

6. Common Antibiotic Therapies in the Treatment of Chronic Periodontitis

1. Doxycycline / minocycline : 100-200mg/q.d for 21 days.
 2. Azithromycin : 500 mg/ q.d for 4-7 days.
 3. Ciprofloxacin : 500 mg/b.i.d for 8 days.
 4. Clindamycin : 300 mg/ t.i.d for 8 days.
 5. Metronidazole : 500 mg/ t.i.d for 8 days.
 6. Metronidazole + Amoxycillin: 250 mg/t.i.d for 8 days.
 7. Metronidazole + Ciprofloxacin: 500 mg/b.i.d for 8 days.
- The above mentioned dosage is the most commonly used drug dosages. The use of these drugs should be

decided by the periodontist. The periodontist prescribes the type of drug depending upon the type of periodontitis. The micro organisms associated with different types of periodontitis varies and thereby the type of the drug prescribed and the dosage also varies.

7. Conclusion

Systemic antibiotics play a major role in treating periodontitis along with mechanical debridement. A wide range of antibiotic spectrum is covered in case of combination antibiotic therapies when compared to single antibiotic therapy. The patient's medical health, allergies and current medications should all be taken into account before an antibiotic is prescribed to the patient in treating any type of periodontitis¹⁷. The dentist should be aware of the fact that the non-specific or indiscriminate use of antibiotics may generate problems related to increase side-effects and bacterial resistance as a whole. However, when properly used, systemic antibiotics are very important tools in the treatment of periodontal diseases as well as of other oral infections.

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