

# BACTERIAL ENDOCARDITIS IN DENTISTRY: DISEASE AND DRUG PROPHYLAXIS

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## ABSTRACT

In dentistry, the gingival fissure around the teeth or tissue damage produced by surgical and/or accidental procedures can be a gateway to oral microbiota, directly into the bloodstream, which can result in the colonization of the endocardium, causing infective endocarditis. Infective endocarditis is caused by the infection of the endocardial surface, characterized as a rare disease, but which, if triggered, can cause inflammation and destruction of the endocardium, heart valves or vascular endothelium. Since the discussion about the use or non-use of antibiotic prophylaxis is not pacified in the Dental literature, this review aims to explain about the necessity of antibiotic prophylaxis prescription to the patients considered at risk, with potential risk and low risk of infection associated with dental surgery.

**KEYWORDS:** Endocarditis, antibiotics, dental surgery.

## 1. INTRODUCTION

In dentistry, it is already established in the literature that a simple gingivitis or periodontitis may be the gateway to the infective endocarditis. Romans & App (2009)<sup>1</sup> shown that, with one gingival bleeding, endocarditis can be triggered by using a simple water jet for cleaning. Thus, it is possible to say that periodontitis can be chronic and infectious diseases with the potential to result secondarily severe systemic infectious diseases in predisposed individuals or under favorable conditions. Conversely, considering the development of systemic infectious diseases, periodontal disease should be considered as an important contributing factors<sup>2</sup>.

The aims to explain about the necessity of antibiotic prophylaxis prescription to the patients considered at risk, with potential risk and low risk of infection associated with dental surgery.

## 2. MATHERIAL AND METODS

The development of this integrative review we chose the proposal of Ganong (1987)<sup>3</sup>, according to the following steps: 1) identification of the research question, followed by a search of the descriptors or keywords; 2) determining the criteria for inclusion or exclusion of research in online databases; 3) categorization of studies, summarizing and organizing relevant information; 4) assessment of studies for critical analysis of the extracted data; 5) discussion and interpretation of the examination results, contextualizing theoretical knowledge and evaluating their applicability as; 6) presentation of the integrative review and synthesis of knowledge of each article reviewed briefly and systematic way.

In the present study the guiding question of the integrative review was: to review the literature to compile a study about the use or non-use of antibiotic prophylaxis in order to prevent bacterial endocarditis.

Bases (Latin American and Caribbean Literature on Health Sciences) LILACS, SciELO (Scientific Electronic Library on Line) and PubMed (NCBI US National Library of Medicine National Center for Biotechnoloin Dentistry Information) were consulted. Studies that have addressed the thematic, published from 1973 to 2011, regardless of the languages of publication were included. Lastly, following controlled for the search and also used as keywords descriptors were used: Endocarditis, antibiotics, dental surgery.

## 3. LITERATURE REVIEW

Horder (1909)<sup>4</sup>, based on his studies found an association between dental health and infectious endocarditis, as the oral cavity, as well as the high digestive tract surfaces are populated by a native microbiota. So, the gingival crevice around the teeth or even micro trauma can

act as a gateway for these microorganisms of the oral microbiota into the bloodstream, resulting in bacteremia, transient or none. Table 1 lists some of the major systemic infectious diseases that may be associated with periodontal diseases.

**Table 1.** Correlation between periodontal diseases and secondary systemic diseases.

AFFECTED SYSTEM/ ORGAN	SYSTEMIC DISEASES CORRELATED TO INFECTIOUS PERIODONTAL DISEASES
Heart	Angina pectoris, myocardial infarction, endocarditis
Vascular System	Vascular Accident (CVA)
Central Nervous System	Meningitis, brain abscess
Lung	Pneumonia

Source: Herbet *et al.* (2006)<sup>5</sup>.

For this reason, classically COTRAN *et al.* (2010)<sup>6</sup> defined that infective endocarditis is a disease caused by colonization or invasion of the heart valves (or the mural endocardium) by a microbiological agent, leading to local formation of thrombotic masses full of microorganisms, known as infective vegetation. Similarly, this colonization can occur in the aorta and aneurysm sac in other vascular beds.

Under the cardiovascular perspective, according to David *et al.* (2008)<sup>7</sup>, endocarditis can originate from turbulent blood flow as a result of congenital or acquired heart disease. Turbulent blood flow can damage the integrity of the endocardium, activating the platelet adhesion and fibrin network in the cardiac tissue, resulting in a sterile vegetative formation known as non-endocardial thrombotic. Moreover, microorganisms entry into the bloodstream can result in colonization of the previously damaged endocardium, causing endocarditis. Studies of Beck *et al.* (1996)<sup>7</sup> corroborate the idea that periodontal disease can be correlated to cardiovascular disease. In a longitudinal study of more than 1,100 men, Herbert *et al.* (2006)<sup>5</sup> noted that periodontitis with great depth on probing exchanges, regardless of other factors, increases the risk of coronary heart disease.

In this respect, it seems that there is a similarity on many occasions, between etiologic factors of the disease and the microorganisms found in the oral cavity (streptococcal infection) infected dental pulp and periapical lesions. The literature has reported cases of sub acute bacterial endocarditis after dental extractions produced, since transient bacteremia often follows tooth extraction) and it almost always occurs within a few weeks to a few months after that operative procedure<sup>9</sup>.

### Etiologic agents:

Virtually all microorganisms have been implicated in the occurrence of endocarditis. Infective endocarditis is a

high risk of infection, usually triggered by microorganisms (Streptococcus) of exposed defects of the buccal cavity (dental plaque formation in the heart valves). There are countless microorganisms that, when they fall into the bloodstream after trauma or manipulation of tissues, can cause infective endocarditis: bacteria, as *Rickettsias* or *Chlamydia*, *Mycoplasma* or fungi. Especially susceptible areas of the cardiovascular system are those with slower blood flow or great turbulent<sup>5</sup>. The oral cavity is a common source of infectious microorganisms triggering of endocarditis. Streptococci are the main cause (viridans type, gram-positive) found, especially *Streptococcus sanguis*. In *S. aureus* and *S. epidermidis* it has become increasingly common to the detection of *A. actinomycetem comitans*, *Hamophilus* spp., *Cardiobacterium* spp., *Eikenella corrodens*, *Kingella* spp., the genus *Capnocytophaga*, and *Neisseria* spp. For antibiotic coverage of patients at risk of infective endocarditis, are recommended bactericidal antibiotics of the family of Penicillin. Since 1983 was considered the case of use of metronidazole as an additional drug to antimicrobial prophylaxis of endocarditis<sup>5</sup>. However, you can observe the prevalence of some strains on the other. Infections with gram-negative microorganisms is accompanied by the release of inflammatory mediators in the bloodstream, including, systemic action of cytokines (TNF, IL-1, IL-6), growth factors and prostaglandins<sup>5</sup>.

Gram-positive microorganisms can also cause serious heart conditions; streptococci - among those of the oral cavity, especially *S. sanguis* - trigger or aggravate the feared endocarditis. Transient bacteremia can be caused by viridans group of streptococci in the dental surgical or invasive procedures which can result in bleeding, even during routine activities. The frequency and intensity of bacteremia arising are related to the nature and magnitude of the trauma of the tissue, the density of microorganisms and the degree of inflammation or infection at the site of trauma. The species of microorganisms that enter the bloodstream depend on the endogenous microbiota that colonizes the injured site<sup>5</sup>.

### Classification of endocarditis

In the acute form, the patient does not have any heart problem although the disease is in quiet development. In the sub acute form the patient is at higher risk to get the disease. Therefore, the performance of any surgical procedure needs further care. In the production of sub acute bacterial endocarditis is a prerequisite prior damage to heart valves. The valve lesions may be congenital or caused by rheumatic fever. When there is bacterial, transient or intermittent invasion, the bacteria are eliminated by the defense mechanisms, however, in individuals who are carriers of previous heart damage, the bacteria can settle on the heart valve and cause sub acute bacterial endocarditis<sup>9,10</sup>.

## Symptoms:

The presentation of sub acute disease is very different from the acute illness. At first, the fever can be low, particularly in the elderly can be discreet or absent. In general the only signs are nonspecific - fatigue, weight loss - without much to indicate the heart. The blows are absent in 10% of patients with sub acute disease furthermore can be associated only with an existing heart abnormality<sup>6</sup>. Sub acute has greater interest to the dental surgeon therefore arises for introduction of microorganisms into the bloodstream during the performance of dental procedures in patients at risk. Its symptoms are vague and insidious, including fever, weakness, weight loss, dyspnea, anorexia, progressive muscular and joint pain and weakness in the face and limbs similar to stroke, so that may be months before it is diagnosed<sup>11</sup>.

In contrast, acute endocarditis has a stormy beginning with rapid development of fever, often with peaks, chills, weakness and lassitude. There exists a higher probability of a blow with acute endocarditis due to the large size of the vegetation, and often change as they grow and vegetations fragment. The spleen presents increased with greater frequency in the acute form of the disease than in the subacute<sup>6</sup>.

## Patients with cardiac risk:

The identification of patients with differentiated risk goes through a detailed history. Questions related to heart health of the patient on the existence of prosthetic valve, if user cardio intravenous vasoactive drugs or, if you have diabetes mellitus type I or II, whether or not frequent user of alcoholic beverages, tobacco or other drugs, licit or illegal<sup>12</sup>. These high-risk patients can develop endocarditis after performing invasive dental procedures, with the entry of bacteria or fungi even in the circulatory system. In the case of fungi, we can mention the acute and sub acute endocarditis<sup>2,13</sup>. Previous studies associated with numerous reports of patients who developed infective endocarditis are the basis for the recommendation of antibiotic prophylaxis<sup>14-20</sup>.

In this sense, strongly grounded in the literature, few clinical conditions of the patient identified as being at high risk of endocarditis or average risk of endocarditis, according discrimination below, proposed by Junior & Zanatto (2003)<sup>12</sup>, and reviewed later by Sampaio *et al.* (2008)<sup>21</sup>.

### High risk of endocarditis

- Use of biological or mechanical valve prostheses
- Infective endocarditis history, even in the absence of heart disease

### Medium risk of endocarditis

- Congenital valve defect or acquired
- Congenital heart defect, such as:

- Aortic isthmus stenosis
- Blood Canal (ductus botalli) open
- Ventricular septal defect (type ostium primum)
- Sub aortic stenosis or supraaortic
- Tetralogy of Fallot
- Palliative surgery history of congenital heart defects
- Correction of congenital heart defects incomplete
- Hypertrophic obstructive cardiomyopathy (HOCM)
- Mitral valve prolapse (MVP) with systolic noise

### Normal risk (without lift) of endocarditis

- Atrial septal defect
- Successful surgery History correction of atrial or ventricular septum (6 months without waste)
- Coronary bypass surgery history (bypass)
- Mitral valve prolapse (MVP) without systolic noise
- Physiological cardiac noise, functional or harmless
- Kawasaki disease without valvular dysfunction

### History

- History of rheumatic fever without valvular dysfunction
- Pacemaker Use
- Stenosis surgery History of the aortic isthmus

### Management of positive cases of endocarditis in dental patients

The diagnosis of bacterial endocarditis has been made in blood cultures and viewing bacterial vegetation through the echo cardiogram<sup>21</sup>.

Although endocarditis be related recurrently in dental patients, today many professionals know little or unaware of this form of complication, let alone how to prevent it or treat it. Nascimento *et al.* (2011)<sup>22</sup> showed that a large proportion of professionals knew the possibility of heart infectious complication after performing surgery, but did not declare consistent knowledge of antibiotic prophylaxis or merely stated that they mastered topics related to endocarditis.

### Prevention of bacterial endocarditis

Thus, antibiotic prophylaxis would be indicated prior to invasive procedures, such as periodontal treatment, extractions, dental replantation, endodontic instrumentation, intra ligamentous injections, among others. On the other hand, in non-invasive procedures such as dental restorations, antibiotic prophylaxis may be eliminated. Currently, the antibiotic of choice is amoxicillin.

### Prophylactic protocols

It is definitely accepted to be administered before the antibiotic in patients who have rheumatic fever or other known sign of any valve damage and will undergo certain dental treatments, including treatment of root canals<sup>9</sup>.

The adult patient must receive 2g of the drug one

hour before the surgical procedure. Amoxicillin is used by being well absorbed from the gastrointestinal tract, have broad action spectrum for positive and Gram-negative bacteria but also by its favorable historic or low levels of adverse side effects, although it is a synthetic penicillin. However, there are patients allergic to amoxicillin. In these cases, it is possible to hold the antibiotic prophylaxis using: clarithromycin or azithromycin, both drugs of the macrolide class, or clindamycin group of lincosamides. If there is the need for multiple invasive procedures on the same patient, research shows that to be respected a minimum of 10 days between a procedure and another, so that there is the emergence of microorganisms resistant to the antibiotic of choice. Another strategy would be to alternate the use of the above antibiotics, in order to create an element of surprise to the microorganism and thus minimizing the chance of emergence of resistant strains<sup>23</sup>.

**Table 2.** Prevention of endocarditis - antibiotic prophylaxis

Patient	Antibiotic	Adult	Child	Use before intervention
Prophylaxis standard	Amoxicillin	2 g oral	500 mg/kg oral	1h
Do not swallow pills	Ampicillin	2 g im/iv	50 mg/kg im/iv	30 min
Allergic to penicillin	Clindamycin	600 mg oral	200 mg/kg oral	1h
	Cephalexin			1h
	Cefradoxil	2 g oral	50 mg/kg oral	
	Azithromycin			1h
	Clarithromycin	500 mg oral	15 mg/kg oral	
Not swallows pills and is allergic to penicillin	Clindamycin	600 mg iv	20 mg/kg oral	30 min
	Cefazolin	1 g im/iv	25 mg/kg oral	30min

Source: Herbert *et al.* (2006)<sup>5</sup>; Wilson *et al.* (2007)<sup>23</sup>.

### Necessary or unnecessary prophylaxis in practice

**Table 3.** Type of dental procedure and antimicrobial prophylaxis recommendation.

<b>Dental interventions: Recommended</b>	<b>Dental interventions: Non-recommended</b>
Anesthesia - injection intra ligamentous	Local anesthesia (except intra ligamentous)
Surgery - tooth extraction, other interventions	Prosthetic or restorative treatment, with or without the use of retraction cord
Periodontics - Survey; scaling and root planning; surgery; control sessions, maintenance/recall; placement of release devices subgingival drugs.	Endodontics: canal treatment, intra-radicular pin placement, etc.
Implantology - Surgeries to implant placement.	Other: Isolation with rubber dam and suture removal; moldings; X-rays; adjustment of orthodontic appliances
Endodontics - Instrumentation or surgery exceeding the root apex	Deciduous teeth extraction in exfoliation-way
Procedimentos de profilaxia, quando a ocorrência de sangramento é provável	Perform prophylaxis when bleeding is provided

Source: Herbert *et al.* (2006)<sup>5</sup>; Sampaio *et al.* (2008)<sup>21</sup>.

Table 3 summarizes the main dental procedure with its respective recommendation or absence of antimicrobial prophylaxis.

When a treatment with a long time is planned, it should be expected to use in this period of complementary medicine - combined with an antiseptic regime. When it opts for antimicrobial prophylaxis for use, before dental procedures, the main antibiotics used are shown in Table 2 and 4, so that the information from both tables are complementary.

**Table 4.** Protocol for administration of antibiotics for dental procedures.

Administration route	Medication	Child-Dosage before procedure	Adult-Dosage before procedure
Oral	Amoxicillin	50 mg/ kg	2 g
Allergic to Penicillin	Clindamycin	20 mg/ kg	600 mg
	Azithromycin	15 mg/ kg	500 mg
	Clarithromycin	15 mg/ kg	500 mg
I.M / I.V.	Ampicillin	50 mg/ kg	2 g
	Cefazolin	50 mg/ kg	1 g
	Ceftriaxone	50 mg/ kg	1 g
I.M / I.V. to Allergic to penicillin	Clindamycin	20 mg/ kg	600 mg

Source: Cavezzi Jr (2010)<sup>24</sup>.

## 4. CONCLUSION

Infective endocarditis as a possible complication that should be taken seriously by Dental Surgeons, as suggested by many authors, which describes emphasizing the loss of specific functions of the cardiovascular system, with real risk of death for the infected patient.

The routine use of antibiotic prophylaxis must be performed in high-risk patients who will undergo invasive dental procedures such as handling or drilling gingival tissue of the oral mucosa. The Dental Surgeon could also consider the use of antimicrobial prophylaxis in patients defined as low-risk, in order to standardize its procedures in clinics, especially considering the existence of clinical-school, with the attendance of thousands of people annually. However, non-invasive procedures such as restorations, application of sealants and others should not use antibiotic prophylaxis, since it takes the patient's health assessment immune feasibility assumption of the patient and the negative of infectious diseases in the recent past of the patient.

Thus, the Dental Surgeon could consider two fundamental aspects to indicate antibiotic prophylaxis of infective endocarditis: 1- the identification of high-risk patients to acquire the infective endocarditis and have chance to develop into a more serious condition; 2- the identification of dental procedures with greater risk to provide the endocardium infection.



Finally, we reiterate that antimicrobial prophylaxis is still one of the most effective ways to effectively prevent infective endocarditis in patients with known risk, potential or remote.

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