

# Oral Bacterial Infections

## Diagnosis and Management



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### KEYWORDS

• Bacteria • Infections • Oral cavity • Microbiology • Microbiome

### KEY POINTS

- There are more than 500 bacterial species from several phyla associated with various niches within the oral cavity, as commensals or pathogens.
- It is often difficult to distinguish true pathogens from commensals and this is further exacerbated by the development of polymicrobial infections.
- The diagnosis of oral infections is usually a clinical one but microbiologic diagnosis assists with appropriate therapy and spares unnecessary use of powerful antibiotics.

### INTRODUCTION

#### *Normal Flora of the Oral Cavity or the Human Oral Microbiome*

The human oral microbiome consists of the microorganisms present within the oral cavity and its adjacent structures extending to the distal third of the esophagus.<sup>1</sup> These structures provide distinct microbial habitats that include the teeth, gingiva, tongue, hard and soft palates, cheeks, and lips. Contiguous structures, such as the tonsils, pharynx, Eustachian tube, middle ear, trachea, lungs, nasal cavity, and sinuses, also provide a niche for various microorganisms.

More than 500 different bacterial species have the capacity to inhabit the oral cavity, but only 280 have been isolated by standard culture methods.<sup>2</sup> These organisms are protective against invasion by other pathogenic species, or are associated with oral and systemic diseases. Molecular studies suggest several phyla to which these organisms belong: Bacteroidetes, Firmicutes, Tenericutes, Actinobacteria, Proteobacteria, Euryarchaeota, Chlamydiae, and Spirochaetes. Commonly isolated species include streptococci, actinomycetes, veillonella, and diphtheroids, and gram-negative anaerobic rods.<sup>3</sup> These organisms are site specific or host specific, transient or resident.<sup>2,3</sup>

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Disclosure Statement: The authors have nothing to disclose.

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Dent Clin N Am 61 (2017) 305–318

<http://dx.doi.org/10.1016/j.cden.2016.12.003>

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### Common Bacterial Infections of the Oral Cavity

Bacterial infections presenting to dentists include dental caries, gingivitis, periodontitis, and dental abscess.<sup>4</sup> Clinical versus laboratory diagnosis is commonly done, with the latter providing information on susceptibility, which facilitates culture-directed therapy and judicious use of antibiotics.<sup>4,5</sup> The information provided from these tests is used to guide and measure a response to therapy. Rapid point-of-care tests are being developed that will result in clinicians acquiring microbiologic diagnoses in far less time than with conventional tests.<sup>4</sup> Knowledge of the likely implicated pathogen and related antibiograms will prove useful in guiding empiric therapy.

Dental caries refers to tooth decay that occurs postcolonization and adherence to teeth by microorganisms originally a part of the normal flora. Disruption of the balance within the microbiome leads to a breakdown of the tooth enamel.<sup>6</sup>

Such organisms as *Streptococcus mutans*, *Actinomyces* spp, and others usually colonize first (Table 1).<sup>7</sup> Secondary colonizers include *Fusobacterium nucleatum* and *Prevotella intermedia* (see Table 1). This eventually leads to biofilm and plaque formation. Those at the core tend to be anaerobic and those at the surface, aerobic.<sup>4,7</sup> The acid produced from carbohydrate accumulation erodes teeth enamel, which may initially appear discolored and later develops into a cavity. If the cavitation thus formed is deep enough it may involve the pulp of the tooth.<sup>4</sup>

Characteristics of the Microbial Composition of Caries	
Organism	Characteristic Features
Primary colonizers	
<i>Streptococcus</i> spp	Gram-positive; coccoid in shape; facultative anaerobes; most are mesophiles
<i>Actinomyces</i> spp	Gram-positive; individual colonies are rod-shaped but collectively may appear filamentous; most are facultative anaerobes with the exception of <i>A meyeri</i> ; most are mesophiles
<i>Neisseria</i> spp	Gram-negative; coccoid in shape; some are capnophiles, some are microaerophilic; most are mesophiles
<i>Veillonella</i> spp	Gram-negative; coccoid in shape; obligate anaerobe; mesophile
Secondary colonizers	
<i>Fusobacterium nucleatum</i>	Gram-negative; fusiform rods or spindle-shaped (spindle-shaped rod); anaerobic; able to coaggregate with other species in the oral cavity to form dental plaque; mesophilic
<i>Prevotella intermedia</i>	Gram-negative; rod-shaped; anaerobic; opportunistic pathogen
<i>Capnocytophaga</i> spp	Gram-negative; thin rod-shaped (medium to long rods); gliding ability on agar; facultative anaerobe; capnophile; mesophile
<i>Eikenella corrodens</i>	Gram-negative; rod-shaped; facultative anaerobe; mesophile; bleachy or musty odor; forms pits on chocolate agar
<i>Actinobacillus actinomycetemcomitans</i>	Gram-negative; coccobacillus (curved or straight); capnophile; facultative anaerobe; mesophile
<i>Treponema</i> spp	Gram-negative; spiral-shaped; microaerophilic; mesophile

Data from Refs. <sup>14,15,48</sup>

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