

# Introduction to Clinical Microbiology for the General Dentist



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## KEYWORDS

- Oral microbiology • Clinical microbiology technology
- Antimicrobial susceptibility testing • Microbial risk assessment
- Microbiological testing

## KEY POINTS

- Many oral diseases have a microbial cause that can be characterized and monitored by microbiological testing.
- Clinical oral microbiology helps identify infecting pathogenic agents in oral infections and evaluate their in vitro antimicrobial susceptibility.
- Microbiological analysis supplementing conventional diagnostic procedures may aid dental professionals in clinical decision making and selection of the most appropriate treatment of individual dental patients.
- Microbial-based dental care end points may help reduce clinical treatment failures and improve patient oral health outcomes.
- Recent technological advances in clinical oral microbiology are increasing its utility and value to dental professionals.

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Disclosures: T.E. Rams has nothing to disclose. A.J. van Winkelhoff is a co-owner of LabOral Diagnostics, LabOral International, and BlueClinics, which provide clinical microbiology services for dental professionals.

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Dent Clin N Am 61 (2017) 179–197  
<http://dx.doi.org/10.1016/j.cden.2016.11.001>

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## INTRODUCTION

Major diseases that dental professionals treat daily in clinical practice are primarily of microbial cause and include dental caries, periodontitis, and odontogenic infections. However, in contrast with management of infectious diseases in medicine, there seems to be at present little use of clinical microbiology laboratory testing in the diagnostic assessment and care of dental patients. Treatment of most dental diseases remains largely focused on provision of mechanical-surgical debridement and/or drainage of lesions, with adjunctive local and/or systemic broad-spectrum antimicrobial drug therapy potentially used and empirically selected by the treating clinician without microbiological testing. Although effective in many patients, this mechanical-surgical treatment model may be inadequate in addressing certain types of oral infections, resulting in clinical therapeutic failures. This article provides an overview of the present status of clinical microbiology in dentistry, and how it may be used by dental professionals to better optimize selection of therapy and potentially improve patient oral health care outcomes, with emphasis on management of chronic periodontitis.

## ORAL DISEASES OF INFECTIOUS ORIGIN

A wide range of disorders may occur in the human oral cavity from the effects of microbial infections, developmental defects, adverse host immunologic-autoimmune reactions, and growth of different types of benign tumors and cancer. Details on bacterial, viral, and fungal infections in the oral cavity are provided in other articles of this issue, but are summarized for the following oral diseases (**Table 1**).

Dental caries is a multifactorial process driven by acidogenic and acid-tolerant bacterial species fermenting dietary carbohydrates, particularly sucrose, which leads to lowered dental plaque biofilm pH levels and demineralization/cavitation of susceptible tooth surfaces.<sup>1</sup> In United States population-based surveys conducted in 2011 to 2012, 91% of adults aged 20 to 64 years showed evidence of dental caries in permanent teeth, with 27% yielding untreated carious lesions.<sup>2</sup> Among those greater than or equal to 65 years of age, 19% were fully edentulous,<sup>2</sup> mainly as a result of untreated and progressive dental caries.<sup>3</sup> Similar or greater levels of dental caries are found worldwide in various countries and population groups.<sup>4</sup>

High levels of streptococci (in particular *Streptococcus mutans* and *Streptococcus sobrinus*), lactobacilli, Bifidobacteriaceae species, *Scardovia wiggisiae*, and other organic acid-producing bacteria in dental plaque biofilms confer an increased risk for coronal dental caries on smooth tooth surfaces and in occlusal pit and fissures.<sup>5</sup> A similar array of species plus proteolytic/amino acid-degrading bacteria contribute to the development of root surface caries.<sup>6</sup>

Chronic periodontitis is another prevalent oral disease in the United States. Nearly 50% of dentate adults aged 30 years or older, representing 64.7 million people, were estimated to have periodontitis in United States 2009 to 2012 national surveys, with 8.9% revealing severe chronic periodontitis,<sup>7</sup> which is in a similar range to other countries and population groups throughout the world.<sup>8</sup> Risk factors known to modulate expression of chronic periodontitis include subgingival colonization by microbial pathogens; male gender; African American (black) and Hispanic racial identification; smoking; obesity; poor coping with psychosocial stress; certain genetic polymorphisms; poorly controlled diabetes mellitus; and nutritional deficiencies in calcium, vitamin D, and vitamin C.<sup>9</sup>

Several anaerobic bacterial species are frequently increased in the subgingival microbiome of untreated chronic periodontitis, including *Porphyromonas gingivalis*,

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