

# Periodontal Microbiology



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## KEYWORDS

• Periodontal • Bacteria • Disease • Gingivitis • Periodontitis • Periodontopathogens

## KEY POINTS

- Periodontal disease is a mixed bacterial infection that produces inflammatory destruction of the periodontal tissues that surround and support the teeth.
- Periodontal microbiota form a complex ecosystem called dental plaque biofilm, within which pathogens produce virulence factors that allow them to evade host defenses, as well as provoke a host immune response that is damaging to the host tissues.
- Periodontal disease actually results from a disruption of the homeostasis or balance that normally exists between the plaque bacteria, host immune system, and environmental conditions during health.
- The pathogenic bacteria as well as the damaging inflammatory mediators expressed by host immune cells may travel to distant sites through the bloodstream and there induce systemic conditions that could result in heart attacks and strokes.
- Recent advances in molecular biology have enabled the identification of numerous previously undetected bacteria that may themselves play a significant role in the disease.

## INTRODUCTION

There are about 700 species of bacteria known to be capable of colonizing the human oral cavity, but only around 200 to 300 of these would be found in the mouth of any one individual.<sup>1</sup> The oral bacteria have long been considered to be mostly commensal with only a small proportion being pathogenic<sup>2</sup> causing either dental caries or periodontal disease, which are among the most prevalent diseases of mankind.<sup>2</sup>

Periodontal disease is essentially a mixed bacterial infection that produces inflammatory destruction of the tissues that surround and support the teeth.<sup>3</sup> It results from a combination of factors, but its primary cause is bacteria found in dental plaque.<sup>2</sup> When left untreated, this disease often results in loss of the affected teeth, thereby accounting for most teeth that are lost during adulthood.<sup>4</sup>

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The author has nothing to disclose.

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Besides causing tooth loss, periodontal disease also may affect our body's general health.<sup>5</sup> The connection between periodontal disease and overall health is of increasingly greater concern as more evidence emerges linking it with chronic systemic conditions, such as heart disease and respiratory illness,<sup>5,6</sup> as well as with potentially fatal thromboembolic events: myocardial and cerebral infarctions.<sup>5</sup>

The microbiology of periodontal disease cannot be fully appreciated without an understanding of the immunology and the histopathology of the disease because these topics are inextricably interrelated. In our discussion of microbiology, we must also incorporate knowledge from disciplines, such as pharmacotherapeutics and behavioral sciences, in the treatment protocols that we formulate to achieve bacterial or disease control.

## TYPES OF PERIODONTAL DISEASE

There are 2 main types of periodontal disease: gingivitis and periodontitis. There are also different types of gingivitis and different types of periodontitis; however, the chronic form of each is the most common.<sup>7,8</sup>

Gingivitis is an inflammation confined to the keratinized mucosa called gingiva that surrounds the neck of the tooth. This inflammation is evidenced by redness and swelling of the soft tissue as well as bleeding from the gingival sulcus (or gingival crevice) on mechanical stimulation<sup>7</sup> with dental instruments or personal hygiene devices, such as a toothbrush or dental floss. Gingivitis is considered a reversible condition.<sup>7,9</sup>

Periodontitis is an irreversible and more serious condition that generally arises out of long-standing gingival inflammation in susceptible individuals.<sup>7</sup> In periodontitis, the inflammatory lesion spreads from the gingiva into the deeper, supportive components of the periodontium, namely, the periodontal ligament, the cementum, and the alveolar bone.<sup>7</sup> Periodontitis causes destruction of these supporting structures of the tooth and, if it is not arrested, may result in looseness of the tooth and, ultimately, tooth loss.<sup>7</sup> Often, when the term *periodontal disease* is used, especially outside of the academic environment, it is almost always referring to periodontitis only and not to gingivitis.

## EPIDEMIOLOGY

Even though periodontitis develops from gingivitis, not all cases of gingivitis will progress to become periodontitis.<sup>10</sup> The most recent and most accurate large-scale epidemiologic survey to date indicates that roughly half of the adult population in the United States has periodontitis, whereas the other half has gingivitis.<sup>11</sup> Those patients who demonstrate the progressive attachment loss that characterizes periodontitis can be categorized as disease prone, whereas those who have gingival inflammation that never progresses to attachment loss would be categorized as disease resistant. However, the actual transition to destructive disease in any one individual is thought to depend not only on genetic factors but also on the interplay between genetic (host immune), environmental, and bacterial virulence factors.<sup>7,10</sup>

## CHANGES SEEN WITH INFLAMMATION

Healthy gingiva is characterized as pink, firm, stippled, and of knife-edged morphology.<sup>12</sup> Inflammation of the gingiva is triggered by the presence of bacteria in the gingival sulcus and is the body's reaction to what it perceives as an impending bacterial invasion.<sup>13</sup> Clinically, this gingival inflammation is recognized by redness, swelling, a spongy consistency, a shiny smooth surface texture, and bleeding on probing.

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