

What is the Contribution of Genetics to Periodontal Risk?

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KEYWORDS

- Periodontitis • Etiology • Complex disease • Multi-causality • Genetics
- Candidate gene • GWAS

KEY POINTS

- Periodontitis is a multicausal disease, with each of the causal factors playing a role but the relative contribution of these vary from case to case.
- The disease behaves in a nonlinear fashion, with periods of aberrant host response and periods of a disease resolving state.
- To date only a few of the multitude of possible genetic factors for periodontitis have been identified.

INTRODUCTION

Periodontitis is a chronic inflammatory disease of the supporting tissues around the teeth, which results in irreversible periodontal attachment loss, alveolar bone destruction, subsequent tooth mobility, and, ultimately, if left untreated, tooth exfoliation. There are 2 main types of periodontitis: aggressive periodontitis (AgP) and chronic periodontitis (CP).¹ Severe periodontitis occurs in approximately 8% to 15% of the

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population^{2,3} depending on the definitions used for severe periodontitis and depending on the specific study population subjected to epidemiologic studies. In countries with a high availability of dental care, with dental and health awareness, and with preventive measures available, the prevalence of severe periodontitis may be less than 10%.⁴ In contrast, the prevalence can even be greater than 15% in less developed countries with no dental care.⁵ Recent studies suggest that almost half of the population suffers from mild to moderate periodontitis.^{6,7} Nevertheless, severe periodontitis is a disease occurring only in a minority of the population (8%–15%)^{6,8} and specific susceptibility factors play a role.

This article discusses the multicausal etiology and complexity of periodontitis with emphasis on the genetic risk factors. It is based in part on a recent review.⁹

PERIODONTITIS IS A COMPLEX DISEASE

The current concept of the etiology of periodontitis is that it is a *complex disease*. Complexity of periodontitis means that it is a process involving multiple causal components,^{10,11} which interplay with each other simultaneously. Complex systems are almost always *nonlinear*. Nonlinearity in complex systems means that the causes and effects are disproportional so that a small cause may result in a large effect or a large cause may result in a small effect, *and* that the disease progression rate fluctuates, or rather, can move from one state to another and back. Nonlinearity in periodontitis is revealed by heterogeneity in its clinical course; the latter is a common clinical finding by the many periodontal specialists who treat patients with periodontitis.

There are several main causal risk factors: (1) the subgingival bacterial biofilm on both the tooth root surface and on the pocket epithelial lining¹²; (2) genetic risk factors and epigenetic modifications^{9,13,14}; (3) lifestyle-related risk factors, such as smoking, stress and poor diet^{15–17}; (4) systemic disease, notably diabetes¹⁸; and (5) other as of yet unknown factors (eg, occlusal disturbances or fremitus, iatrogenic causes)¹⁹ (Fig. 1).

The 5 main causal components for periodontitis can be brought together into a pie chart. Fig. 2 presents a generic multicausality model for periodontitis, where each of the 5 causal components have an equal contribution.

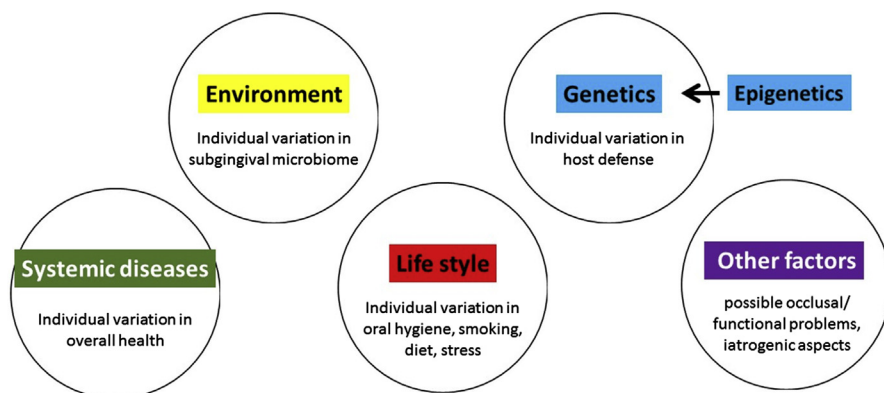


Fig. 1. Periodontitis is a complex disease; multiple causal risk factors act simultaneously in the onset and progression of the disease. Several main causal factors play a role: environmental, (epi)genetics, lifestyle, systemic diseases, and others. (Data from Refs.^{9,12–19})

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