The Anna Karenina principle and gum disease

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Abstract

“All happy families look alike; each unhappy family is unhappy in its own way” – Leo Tolstoy, *Anna Karenina*. According to Tolstoy, a healthy home is the result of many factors falling into harmonious order, whereas disharmony is what happens when even one of these factors is out of place. A new study confirms the same principle holds true for the communities of microbes that determine oral health. Researchers mapped microbial DNA from healthy individuals and individuals with one of three forms of gum infection: chronic periodontitis, localized aggressive periodontitis, or generalized aggressive periodontitis. While it’s known that all three forms of periodontitis are microbially derived, the microbial makeup that gives rise to each remains unclear. High-throughput whole genome sequencing revealed that, like Tolstoy's unhappy homes, no two individuals with disease were alike. In fact, people with chronic periodontitis shared the fewest microbes in common, meaning that chronic periodontitis adhered most closely to the “Anna Karenina principle”, followed by generalized aggressive periodontitis and localized aggressive periodontitis. Additionally, while chronic periodontitis and localized aggressive periodontitis showed signs of being distinct disease entities, generalized aggressive periodontitis shared features of both, suggesting that its manifestation could be a clinical artifact. Understanding these differences are important not only for diagnosing disease in the clinic but also for developing ways of preventing disease in the first place.